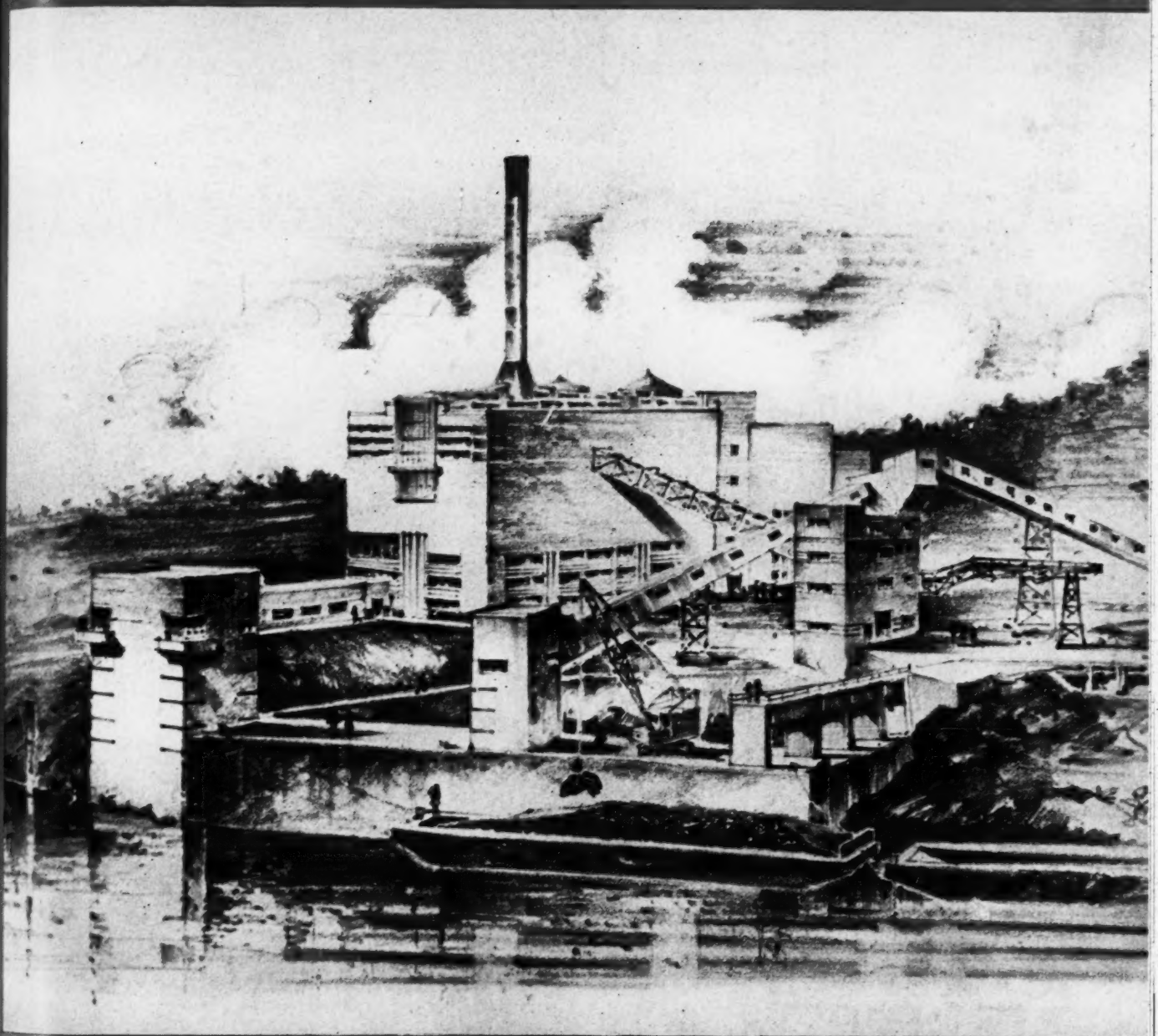
Electrical World

MARCH 17, 1945



Discharged circulating water turbine features above-flood-level plant on Ohio River

Contents: Transformer and Allied Equipment Failure Data

Speed and Load Control on Interconnected Systems

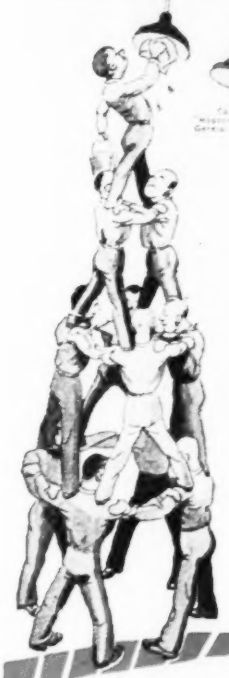
Selling Tomorrow's Load Today • Factors Influencing Rectifier Selection

"Murray" – the modern STANDARD in maintenance ladders!

These maintenance units make overhead servicing *so* fast and easy that light output is kept at maximum.

The chief advantage of these Murray Crows'nests is that they make overhead, out-of-the-way lights, unit heaters and sprinkler heads, easily accessible, without disturbing men, machines or production schedules in the slightest.

All the many important plants which have taken on Murray Crows'nests, wonder how any plant ever got along without them. Fill in the coupon and mail—we'll propose a unit suiting your particular needs. Metropolitan Device Corporation, Brooklyn 16, N. Y.



Metropolitan Device Corp.
Brooklyn 16, N. Y.

Send data (without obligation) on Murray Crows'nest suitable for our requirements. Ladder must reach feet high, and extend feet side-ways. Aisle width is feet.

Name and Title_____

Company_____

Address_____

Murray crows'nest

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

March 17, 1945 Vol. 123, No. 11

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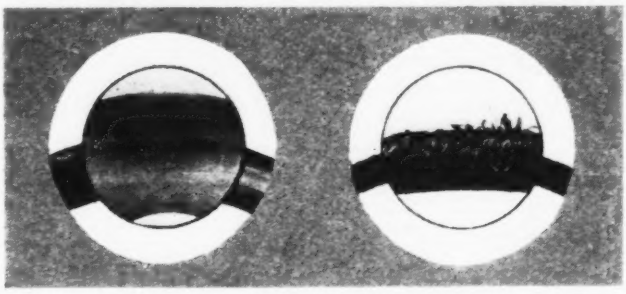
why OKOPRENE protection gives longer life to ELECTRICAL CABLES

Okoprene, compounded with neoprene, is an exceptionally durable covering for cables developed in the Okonite Research Laboratories. It can be bonded to the rubber insulation of individual wires or can be applied as a sheath or jacket over the core of multiple conductor cables. It can be used to protect practically any type or design of cable.

Since 1931, proving ground tests and field experience with millions of feet of wire have been emphasizing the stability and long life of Okoprene coverings under widely varied conditions.

WEATHER RESISTANCE – (Aerial cables, exposed wiring) Okoprene sheaths will not rot or deteriorate when subjected to moisture. The protective covering is flexible at temperatures even lower than minus 18°C. (0°F.) and may be handled in the coldest weather.



Relative deterioration after six years exposure: *Left:* Okoprene sheath smooth and unchanged by elements. *Right:* Saturated braid with compound eroded and braid destroyed.

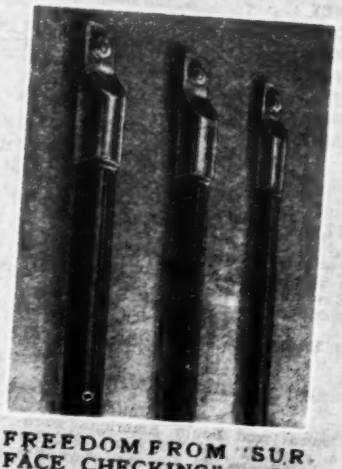
CHEMICAL RESISTANCE – (Cables exposed to fumes or chemicals) The Okoprene jacket has excellent resistance to most acids, alkalies and other corrosive chemicals.

OIL RESISTANCE – (Portable cords, machine tool and shop-wiring, etc.) When exposed to the solvent action of petroleum products, Okoprene sheaths retain their full mechanical strength.

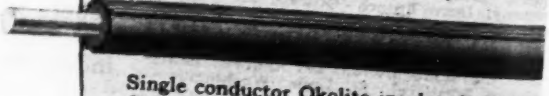
ELECTRICAL STRENGTH – Okoprene itself is an insulating material and thus gives added electrical protection as contrasted with fibrous coverings. When applied over metallic coverings, it protects them from electrolysis. Okoprene will not carry static charges, but does prevent current leakage at terminals and eliminates danger from electric shock.

ENGINEERING HELP – Our experience in dealing with electrical problems since 1878 is at your disposal. For further details on Okoprene protection or other data on cables, we suggest you consult your Okonite representative – or write The Okonite Company, Passaic, New Jersey.

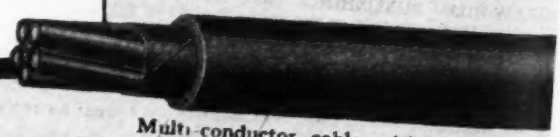
NON-FLAMMABILITY – Okoprene coverings do not support combustion.



FREEDOM FROM "SURFACE CHECKING" – Okoprene coverings, which are bonded to the insulation, protect the rubber insulation up to the terminal and prevent "sun checking" or surface cracks.



Single conductor Okolite insulated and Okoprene protected wire.



Multi-conductor cable with Okoprene covering over each insulated conductor. Okoprene sheath over all.

3942

OKONITE insulated wires and cables

Hardware

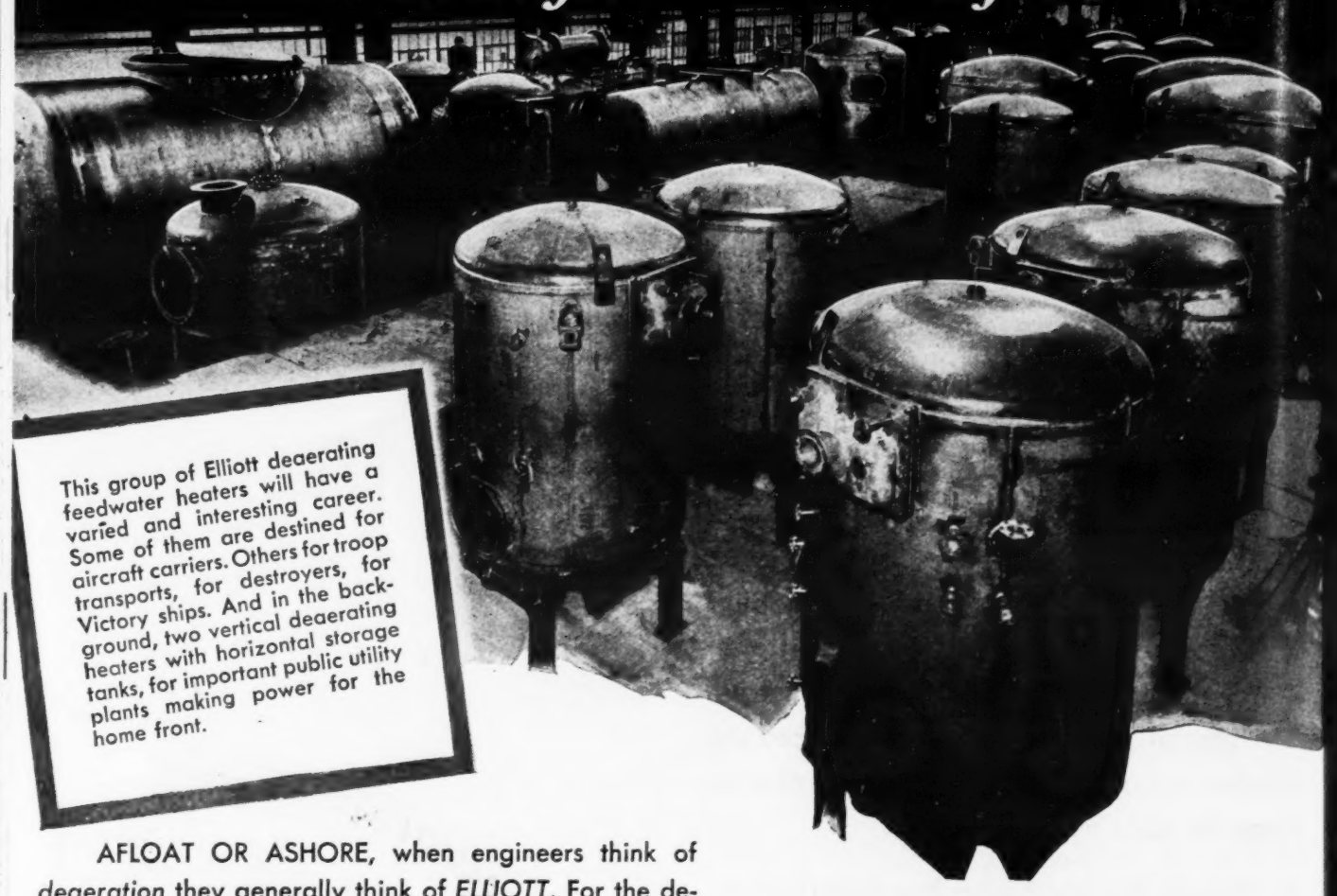
There are three good reasons for selecting Graybar as your source of pole-line hardware. First, Graybar handles Hubbard Hardware – assuring you of finest quality. Second, Graybar's nationwide network of warehouses assures you of the fastest deliveries possible under today's conditions. Third, a nearby Graybar Outside Construction Specialist can give you experienced aid in selecting and applying the right hardware items for your needs.

By making Graybar your headquarters for *all* line materials – hardware, poles, crossarms, insulators, pins, accessories, and tools – you will always be sure of getting materials that fit the job and fit each other. *Graybar Electric Company, Graybar Building, New York 17, N.Y.* 4523

Via GraybaR
...First Source of Pole-Line Supplies

IN OVER 80 PRINCIPAL CITIES

Deaeration for the seven seas
--and for the home front too.



This group of Elliott deaerating feedwater heaters will have a varied and interesting career. Some of them are destined for aircraft carriers. Others for troop transports, for destroyers, for Victory ships. And in the background, two vertical deaerating heaters with horizontal storage tanks, for important public utility plants making power for the home front.

AFLOAT OR ASHORE, when engineers think of *deaeration* they generally think of *ELLIOTT*. For the deaeration principle was first pioneered by Elliott engineers, striking out with typical Elliott enterprise into untrodden fields, aiming for new goals of steam plant economy and efficiency. The successful combining of deaeration and feedwater heating in a single unit is the result of this inspired effort.

With a vast file of correlated data at their command, Elliott engineers design deaeration equipment to meet each individual job or set of conditions, no matter how exceptional those conditions may be.

Your deaeration problem may be simple or complicated. In either case you can with advantage discuss it with Elliott engineers.

ELLIOTT COMPANY

Deaerator & Heater Department

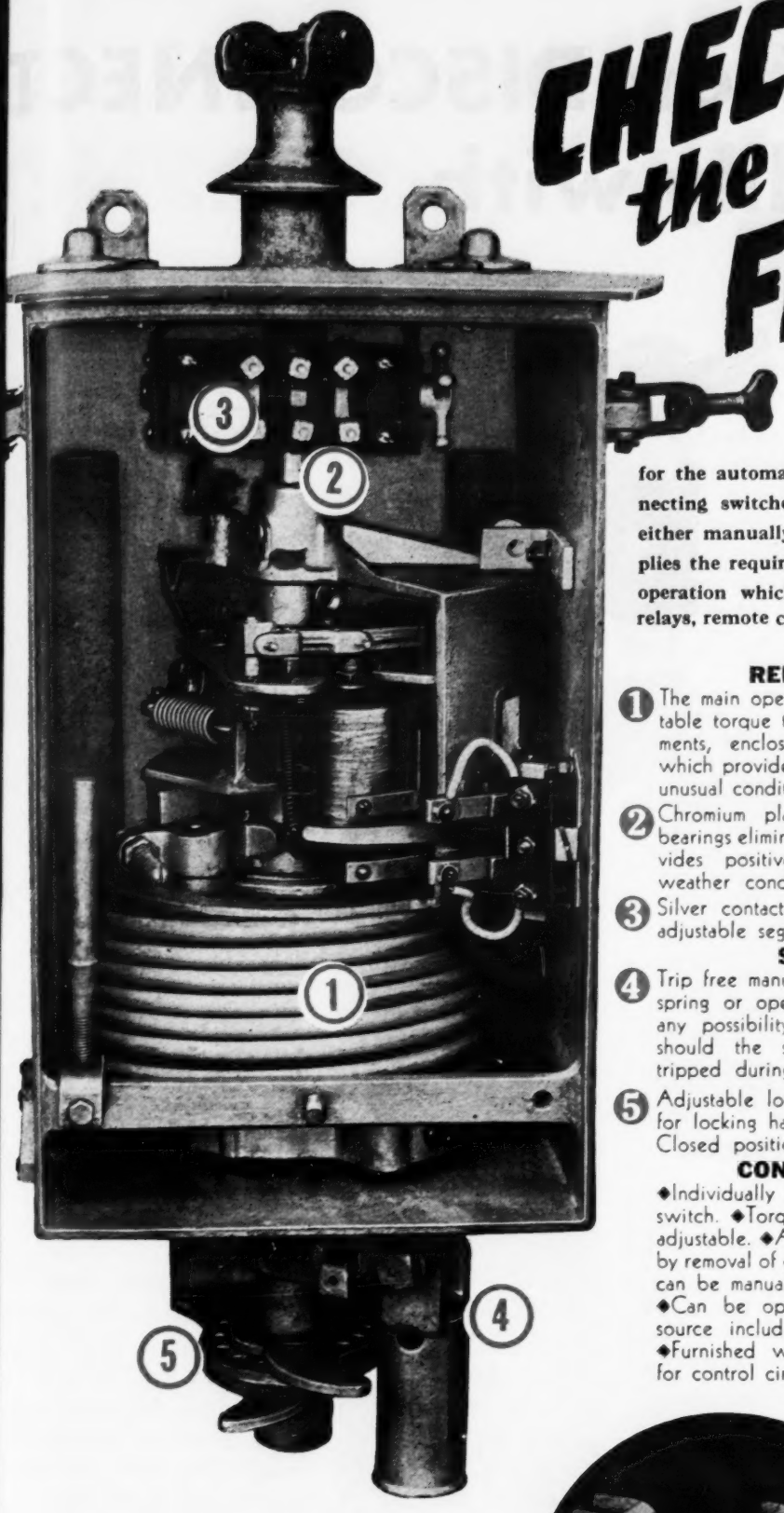
JEANNETTE, PA.

DISTRICT OFFICES IN PRINCIPAL CITIES

N-9818

ELLIOTT pioneered deaeration
–and is still ahead!

CHECK the FACTS



The Type SO-2 is a Spring Mechanism for the automatic operation of disconnecting switches. A torsional spring, either manually or motor wound, supplies the required stored energy for the operation which may be initiated by relays, remote control, or other means.

RELIABILITY

1. The main operating spring, with adjustable torque to suit operating requirements, encloses a "kick off" spring which provides extra torque for ice or unusual conditions.
2. Chromium plated shafts with oilless bearings eliminates maintenance and provides positive operation under all weather conditions.
3. Silver contact auxiliary switches with adjustable segments.

SAFETY

4. Trip free manual handle for rewinding spring or operating switch, eliminates any possibility of injury to operator should the switch be automatically tripped during manual operation.
5. Adjustable lock plates with provision for locking handle in either Open or Closed position.,

CONVENIENCE

◆Individually hand adjustable auxiliary switch. ◆Torque of operating spring is adjustable. ◆All parts readily accessible by removal of one piece cover. ◆Switch can be manually operated at all times. ◆Can be operated from any supply source including dry or B batteries. ◆Furnished with two 1¼" conduits for control circuits.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

●

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

●

HORN GAP SWITCHES

●

INTERRUPTER SWITCHES

●

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

●

SUBSTATIONS

●

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

●

KIRK INTERLOCK SYSTEMS

●

AUTOMATIC SECTIONALIZING EQUIPMENT

●

METAL CUBICLES

●

TESTING DEVICES

R&IE

Type **SO-2**

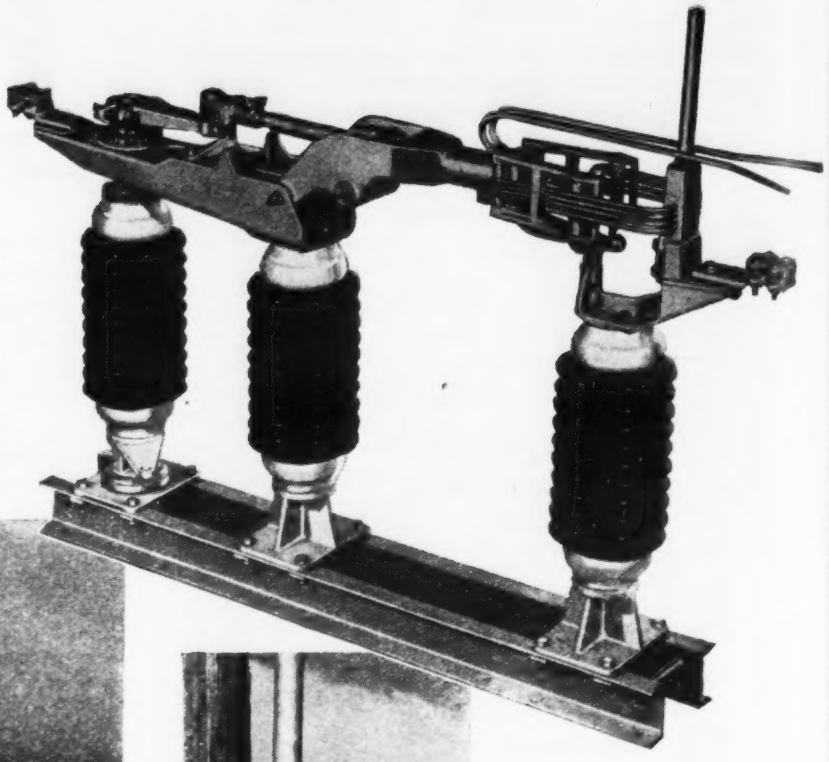
SWITCH OPERATING MECHANISMS

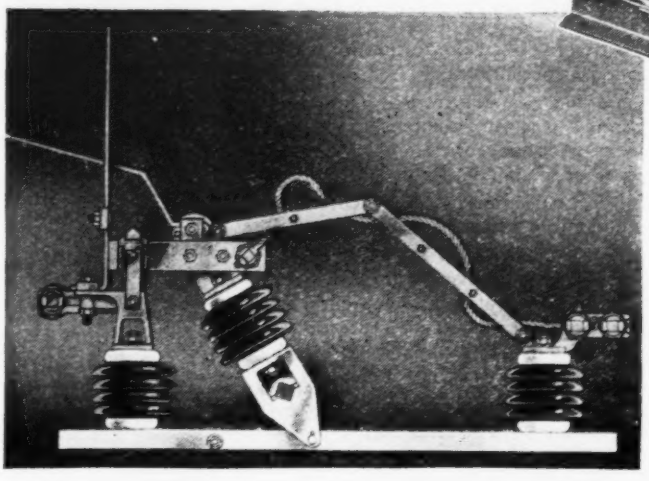
RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

all DUTIES of DISCONNECT
and Speedily with KEARNEY

Kearney ROTATING TYPE GANG SWITCH

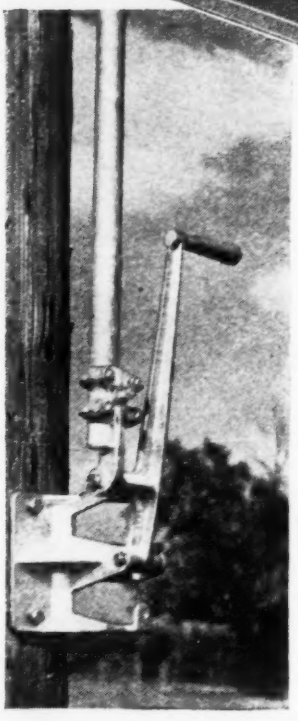
Vertical break type. N.E.M.A. insulators, point pressure contacts, bolted clamp type terminals, horizontal or spade type operating handles. 7500 to 115,000 Volt. 400, 600, 1200 Amp.





Kearney SINGLE BOLT GANG operated SWITCH

For distribution service. All ferrous metal parts are hot dip galvanized, copper or high conductivity copper alloy current carrying parts, rigid pantagraph and Line Pressure contacts for ease of operation under sleet conditions. 200-400 Amp.



Kearney OPERATING MECHANISM FOR GANG SWITCHES

A strong, easily operated switch mechanism. Crank type handle, with over center throw, full bearing and adjustable clamp are features that make this unit easy to install and convenient for the operator.

FURTHER INFORMATION

JAMES R. KEARNEY CORPORATION ST. LOUIS MO. TORONTO, CAN.

The Mark of Quality Products

KEARNEY PRODUCTS — *Designed and Manufactured by*

SOLDERLESS WIRE CON-NEC-TITES • TRIP OUT FUSE CUTOUTS AND CONVERSION ASSEMBLIES • TRIP SAVER FUSE CUTOUTS RECLOSING TYPE • TRIP O-LINK PORCELAIN HOUSED FUSE CUTOUTS • DOUBLE DUTY FUSE CUTOUTS • TRIP-O-LINK FUSE CUTOUTS • TRIP-O-LINK TRIP-SAVER FUSE CUTOUTS • TRIP DISCONNECT SWITCHES • LIGHTNING ARRESTERS • COMBINATION LIGHTNING ARRESTER AND FUSE CUTOUTS • REPEATING FUSE GAP ARRESTERS • ONE TWO INSULATOR FUSE AND DISCONNECT SWITCHES • ROTATING INSULATOR GANG SWITCHES • HOOK OPERATED DISCONNECT SWITCHES • SERIES SECTIONALIZING CUTOUTS • MULTIPLE STREET LIGHTING RELAY • BY-PASS DISCONNECT SWITCHES • POLE TOP GANG OPERATED SWITCHES • PORCELAIN HOUSED DISCONNECT SWITCHES • OIL CIRCUIT BREAKER • FUSE LINKS • SECONDARY FUSES • FUSE PULLERS • EXPANSION ANCHORS, SCREW ANCHORS, BOLTS AND TOOLS • FULL-VU GUY GUARDS • GUY WIRE CLIPS AND STRAND BANDS • SLEEVE TWISTERS AND DIES • ABC SLEEVES AND SPLICING MACHINES • DEAD END SERVICE CLAMPS • FIT-RITE WIRE HOLDERS • 3" CON-NEC-TITES • BUS BAR FITTINGS • RECORDER SELECTOR SWITCH • PHASE ROTATION INDICATOR HI-LINE TOOLS AND ACCESSORIES • CON-NEC-TAP CLAMPS • GROUNDING SETS • TELEPHONE ACCESSORIES

T can be handled more easily
E GANG operated SWITCHES

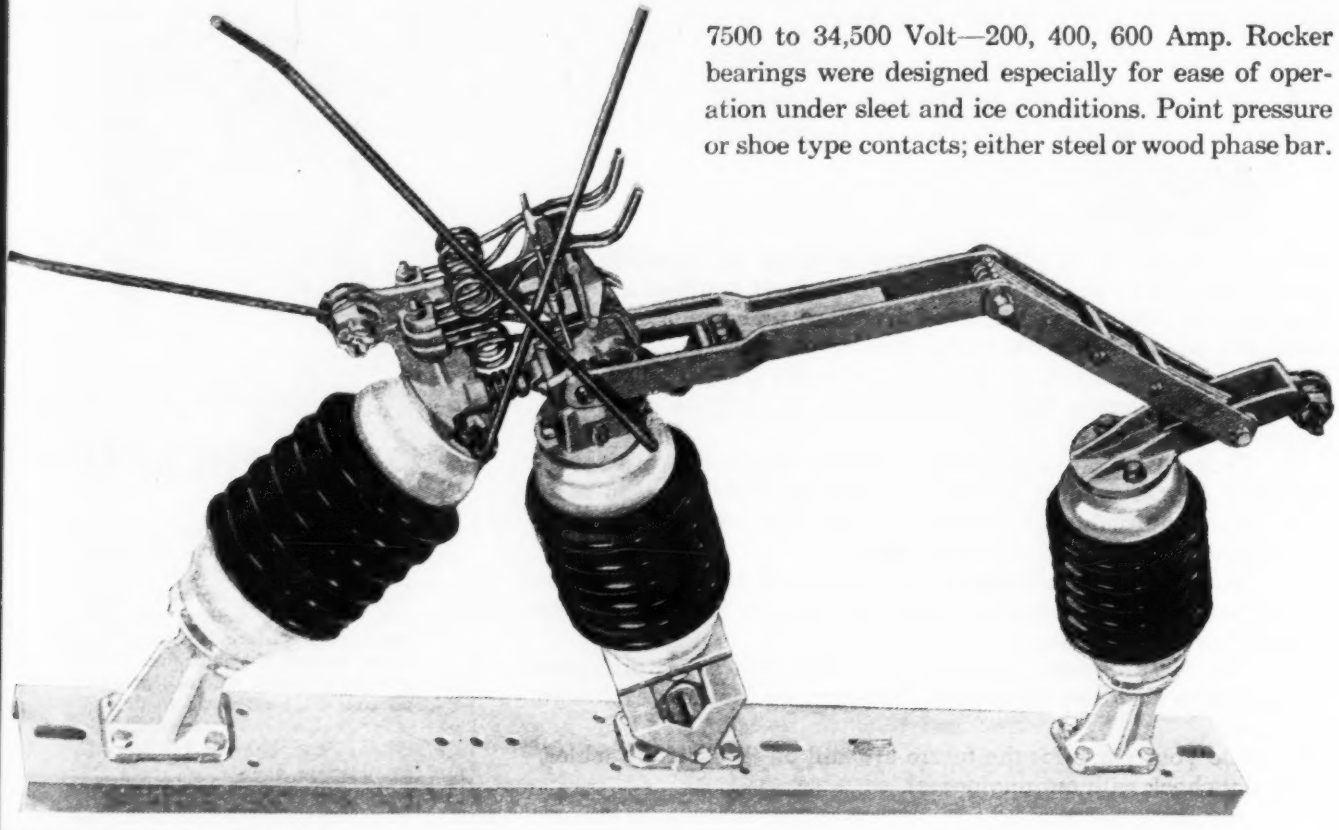
Kearney Gang Operated Disconnect Switches can handle all duties of disconnects with the additional advantage of easy, speedy operation. The mechanical connection and simultaneous break of all phases eliminates the possibility of accidents or fatalities due to one phase remaining closed.

There are three types of Kearney Gang Operated Disconnect Switches — providing a specific switch for a specific job.

The development of Kearney Gang Operated Disconnect Switches includes many new features—some quite revolutionary. Each feature developed has contributed to improved performance, more efficient operation, increased convenience of installation to achieve one prime purpose—satisfactory service.

Our salesman will be glad to work with you in selecting the correct Gang Operated Switch to most efficiently and economically serve you.

Kearney ROCKER TYPE GANG SWITCH



7500 to 34,500 Volt—200, 400, 600 Amp. Rocker bearings were designed especially for ease of operation under sleet and ice conditions. Point pressure or shoe type contacts; either steel or wood phase bar.

AND PRICES ON REQUEST

JAMES R. KEARNEY CORPORATION

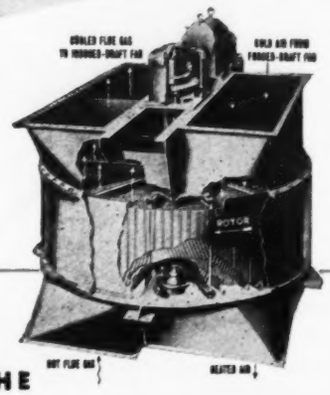
OVERHEAD **UTILITY EQUIPMENT** UNDERGROUND

3124-42 CLAYTON AVE., ST. LOUIS (10) MO. • *Canadian Plant:* LEASIDE, ONTARIO, CANADA

New Solutions

to Heat Recovery Problems may begin with

PREHEAT ENGINEERING



If heat recovery is important to your process, it's possible that some standard or special application of preheat engineering may lead to new operating economies. Here are four specific reasons why you should call in the preheat engineer when plans for new plants, or modernization of old ones, are under consideration.

1. You can design furnaces to take advantage of the benefits of higher heat recovery.
2. Recent new preheater uses, including application to a reverberatory copper-smelter furnace and special applications in sewage treatment plants may indicate how you can increase the efficiency of your production processes.
3. You can take advantage of the added efficiency which generally results from designing a plant specifically for use with the Ljungstrom Air Preheater.
4. The air preheater engineers can help you solve problems arising from corrosion or deposit formation on the heat exchange surface.

So, while your plans for the future are still on the drafting tables, why not check with our engineers?

THE

LJUNGSTROM AIR PREHEATER

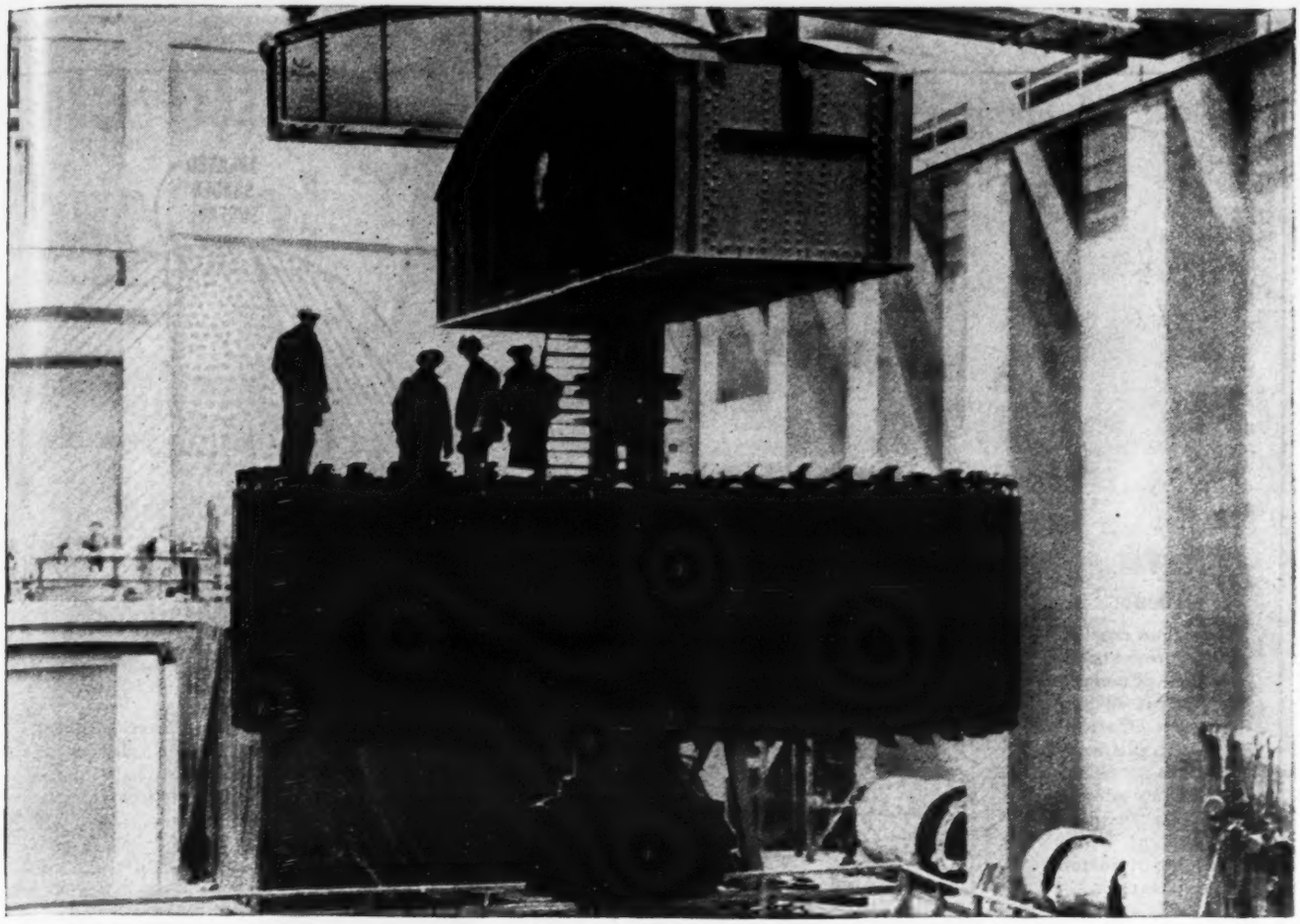
The continuous, regenerative, counterflow principle of the Ljungstrom Air Preheater provides a maximum heat transfer with minimum weight and size. The rotating, cylindrical heat-transfer surface "soaks up" heat in the hot gas chamber, then rotates into the chamber where it gives up this heat to the entering air.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.



Another 75,000 KW... *Now on the line*

ABOVE, the 880,000-lb. rotor and shaft are being lowered into the stator of the second of the five Shasta Dam generators to be installed. This places another 75,000 kw on the line towards the 375,000 kw that will be produced eventually.

Wherever turbines are used to generate electrical energy — in hydro or steam plants — they operate more dependably, require fewer repairs when lubricated effectively. For this reason, plant operators everywhere use Texaco.

There is a Texaco lubricant for every type of turbine. *Texaco Regal Oils (R&O)* for example, are scientifically designed to prevent rusting of turbine lubricating systems. They are highly resistant to oxidation, foaming, sludging and gum formation. Because of these qualities, *Texaco Regal Oils (R&O)* keep turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. They fully meet specifications of all leading turbine builders and the turbine oil specifications of the U. S. Navy.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed at the right.

For suggestions on the proper care of oil and maintenance of turbine systems, call on Texaco Lubrication Engineering Service, available through more than 2300 Texaco distributing plants in the 48 States.

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

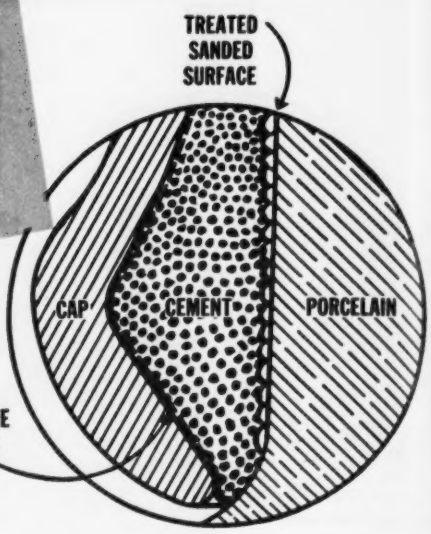
TEXACO

TEXACO Regal Oils (R&O)

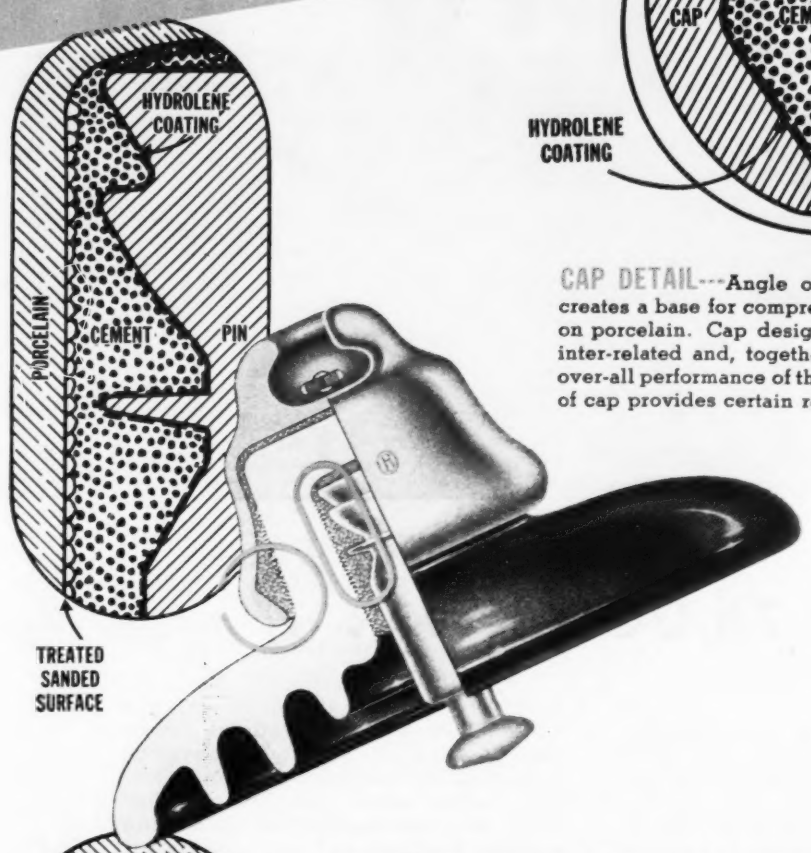
FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS ★ METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

Did You Ever Look At The Insides Of An O-B Insulator?

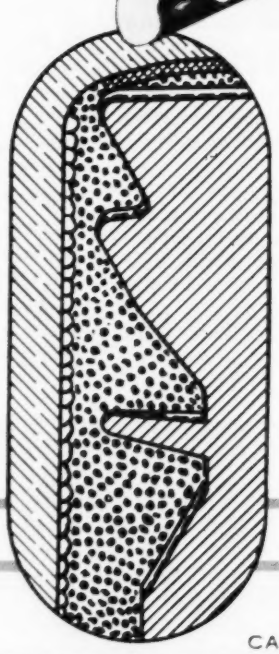


CAP DETAIL---Angle of internal lip of cap creates a base for compression forces that fall on porcelain. Cap design and pin design are inter-related and, together, contribute to the over-all performance of the insulator. Elasticity of cap provides certain relief.



PIN DETAIL
(No Load)

Hydrolene coating on pin prevents adherence of cement so that pin is free to move. Cement is held in place adjacent to porcelain by intimate contact with an infinite number of grain particles in treated sanded surface.



PIN DETAIL
(Loaded)

Load causes slight vertical movement of pin. Thickness of Hydrolene coating provides some of the clearance for this purpose. Certain cement zones go into compression; transmitting this force to porcelain. Flexing of thin lower fin takes some load and provides for recovery.

2598-H

WE CAN scarcely tell you the story of a generation of research and development with a few pictures and lines of type, but here are the high spots of O-B suspension insulator design, in the 15,000-pound range. Inspection and testing is part of the story not pictured. Likewise, manufacturing control. These convert a sound principle into a consistent product--one that enables O-B to guarantee the minimum strength of the unit; and brand that unit with the kind of strength that counts, because you can count on it!

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LTD., NIAGARA FALLS, ONTARIO

Allis-Chalmers Electrodes Have Got To Be Good!

BECAUSE: 1) We use tons of them every day *ourselves*... 2) We constantly test weld metal by X-Ray, tensile machine, metallographic microscope — to assure continual high quality of electrodes.

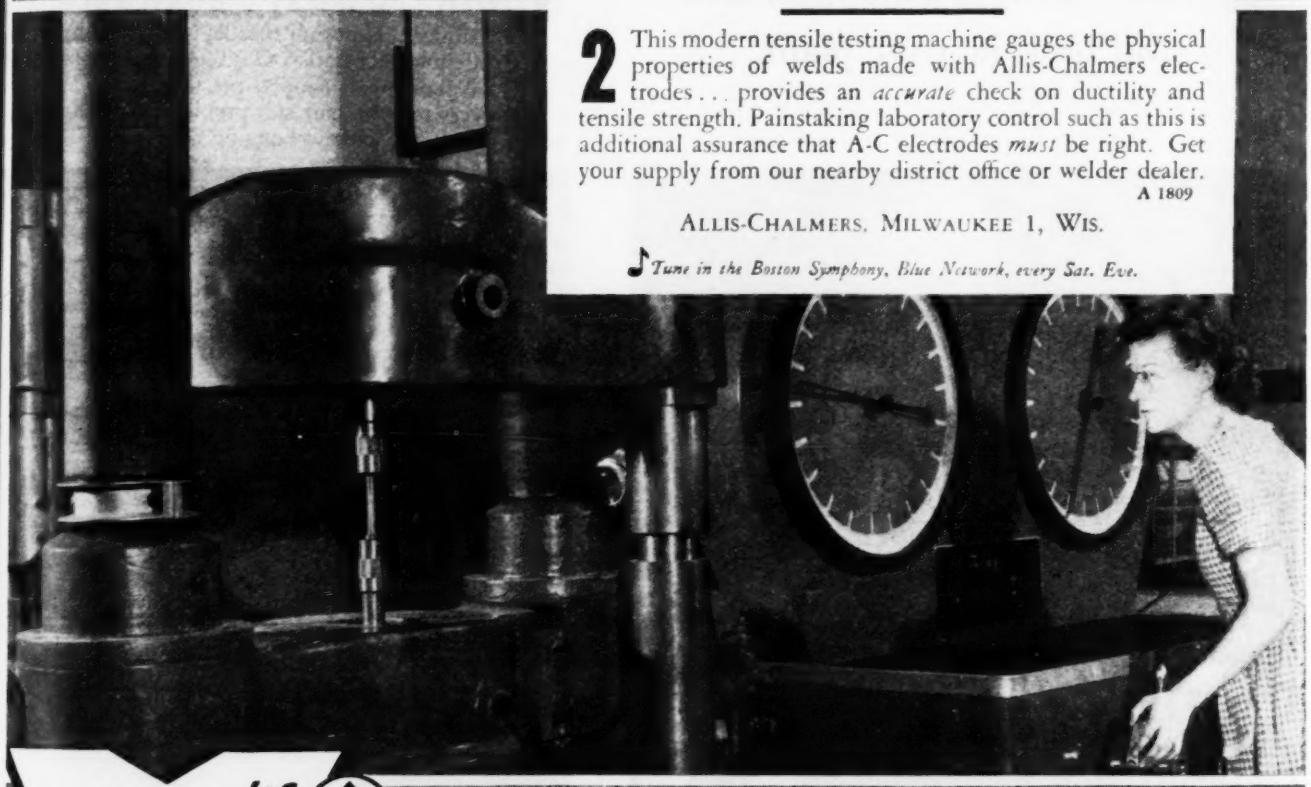
1 Being one of the world's largest *users* of welding equipment, we are able to *production-prove* our electrodes in our own Allis-Chalmers shops—under every type of welding condition. Large welding jobs such as this heavy compressor cylinder are everyday routine. Successful welding of this work *depends* on the quality of Allis-Chalmers electrodes. They've *got* to be good!

2 This modern tensile testing machine gauges the physical properties of welds made with Allis-Chalmers electrodes... provides an *accurate* check on ductility and tensile strength. Painstaking laboratory control such as this is additional assurance that A-C electrodes *must* be right. Get your supply from our nearby district office or welder dealer.

A 1809

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*



A-C Electrodes
EASY TO REMEMBER
EASY TO BUY
Sold by AWS Number

HEADQUARTERS FOR WELDING EQUIPMENT

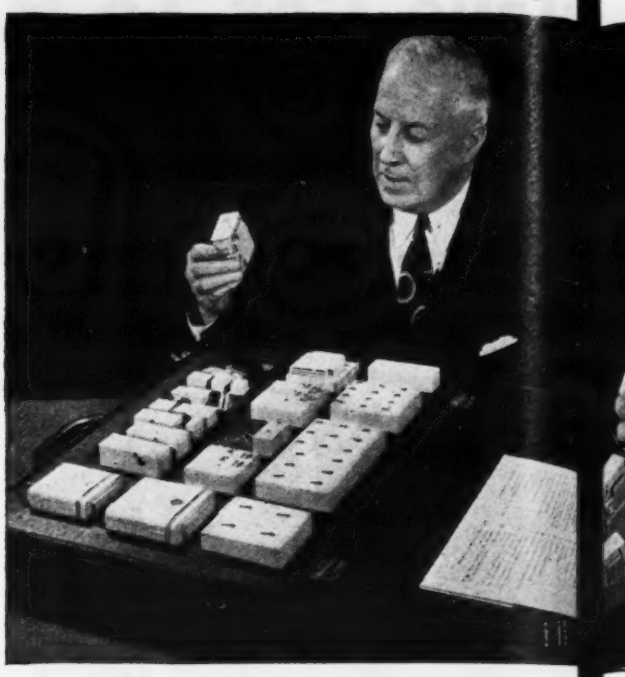
AMPAC A-C WELDERS

WELD-O-TRON D-C WELDERS

ARC WELDING ACCESSORIES

New Model Way

Power distribution problems are worked out quickly and accurately when you use Allis-Chalmers "Unit Sub Builder" Set to help with reconversion, expansion, plant modernization planning. Accurate scale models make it possible for you to *see* available equipment, *see* the various ways it can go together, *see* how the *right* unit substation will look in your plant.



1 YOU SEE WHAT'S AVAILABLE. Allis-Chalmers "Unit Sub Builder" Set contains accurate scale models of all A-C substation equipment. Visual planning is simple, practical, fast. You build the answers to your unit sub problems right on the top of your desk . . . without bogging down in charts, tables

4 SLIDE RULE — designed to calculate secondary short circuit current — helps planner determine proper low voltage breakers. After checking load, he determines how many feeder breakers are needed. Here, low voltage unit is being built: first, bus transition, then, three 50,000 amp air circuit breakers.

5 COMPLETED MODEL unit substation is easily checked for final space requirements. By sketching a section of his plant on cross-section paper to the same scale as models — ½ in. to 1 ft, planner determines quickly and exactly how much space the unit substation will occupy. All guesswork is gone.

to Buy Unit Subs

2 **HANDY "CHECK LIST" BOOK** gives you the added safety of a double check. It helps in the selection of the proper transformer, high and low voltage systems, other considerations when planning a load center unit substation. Weights and dimensions of transformers and switchgear are given.

3 **PROPER SELECTION** of high voltage switchgear is important. Models show at a glance the large variety of equipment available. Here, unit sub planner selects vertical lift switchgear to get protection and flexibility. He uses drop collar throat to simplify connection to 1,000 kva dry-type transformer.

6 **DECISIONS ARE MADE** quickly and easily when Allis-Chalmers "Unit Sub Builder" Set is used to show various arrangements that will fulfill the power distribution needs of your plant. It's a simple matter for other men in your organization to visualize how the *right* unit sub will look when installed.

Work out your Unit Sub ideas with ALLIS-CHALMERS "Unit Sub Builder" Set

To see how the "Unit Sub Builder" Set can help in your unit substation planning, call your A-C district office for a showing. There's no obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1829

REDUCE TIME of SYSTEM OUTAGES with this FAST OPENING and FAST CLOSING

TYPE RDE PACIFIC ELECTRIC BREAKER

This Pacific Electric Breaker reduces time of outages because it clears faults immediately. That is because of the unusually short arcing time, a result of the quick and positive arc-expulsion contacts.

Such fast arc extinguishment together with the fast-tripping action of the properly-designed Motor-Wound-Spring Operating Mechanism insures fast fault clearance. The pre-compressed spring gives fast closing. Fast reclosing is safe, too, because of this certain and fast arc extinguishment. Constant operating speeds at all times permit the use of the breaker for synchronizing.

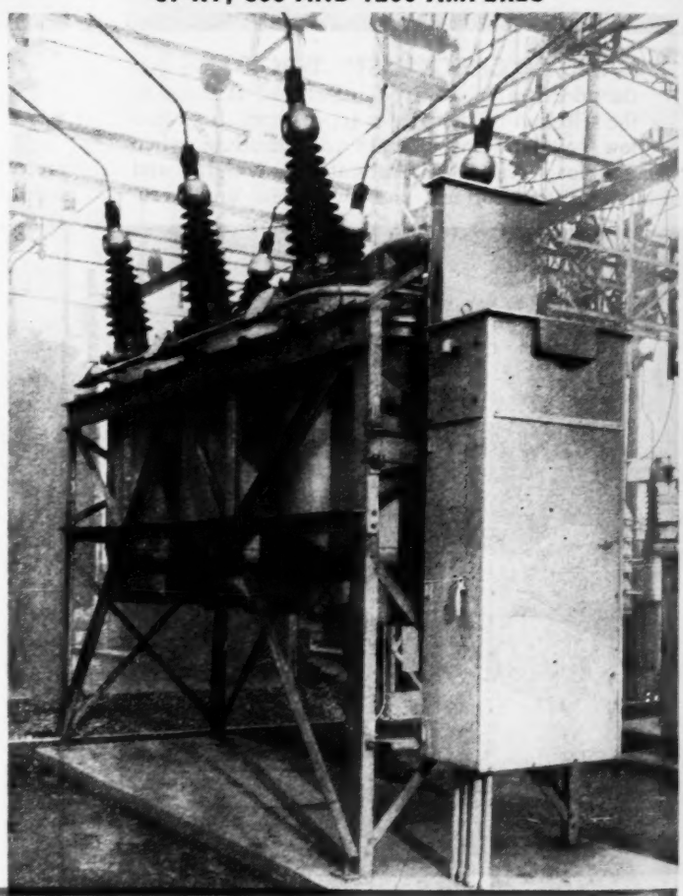
As the motor which automatically pre-compresses the operating spring operates on low current, AC or DC, no rectifiers, no large station batteries and no heavy cables are needed.

Ask for full details—the savings on oil, the reliable insulation, the safe operation assured by positive mechanical drives that end lost motion and the sturdy yet simple construction which assures long trouble-free service with less maintenance. And remember, this breaker, backed by 39 years specialized manufacturing experience, can reduce system outage time because it can reclose quickly as reclosing is done by a spring.

C. H. Cutter 1015 Securities Bldg. Seattle 1, Wash.	G. B. Kirkwood 437 S. Hill St. Los Angeles 13, Calif.	J. E. Redmond Co. 448 W. Madison St. Phoenix, Ariz.
Pierce G. Fredericks 90 West St. New York 6, N. Y.	A. A. Marrs 526 Dwight Bldg. Kansas City 6, Mo.	R. Ackerman 318 Dooly Block Salt Lake City 1, Utah
Walter E. Thompson 447 Martin Bldg. Birmingham 3, Ala.	J. D. Williams 316 Louisiana St. Little Rock, Ark.	J. D. Brosnan 426 Investment Bldg. Washington 5, D. C.

Other Representatives in Principal Cities

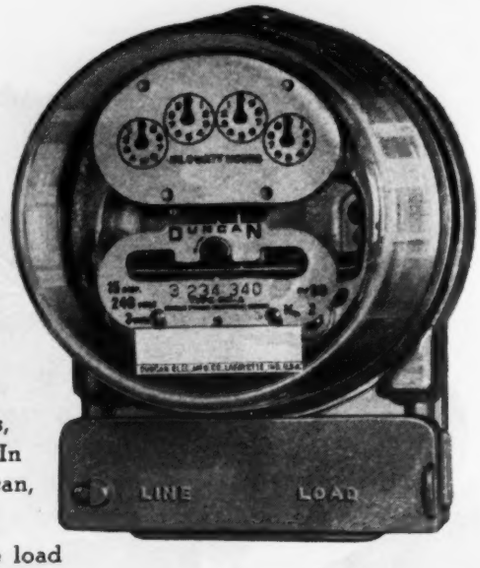
69-KV; 600 AND 1200-AMPERES



Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

Meter it all



ACROSS the evening skyline of the city or along the horizons of the far flung countryside, *the vast use of electrical power is visible to the naked eye.*

Important to companies selling power is the percentage of this power which fails to be recorded on the meters in use. Old or obsolete meters drain away earned profits, here and there, which aggregate an expensive total. In planning post-war meter installations, remember Duncan, the Modern Meter for the Modern Load.

Duncan meters give correct readings for wide load ranges and offer: Straight Line Accuracy up to 400% Rated Load; Alnico Damping Magnet; Porcelain Terminal Blocks; Nobeloy Lifetime Bearings; Micro-set Adjustments and Layer-on-Layer Construction.

ARMY E NAVY

DUNCAN ELECTRIC MFG. CO.

Lafayette Indiana

DUNCAN

WATTHOUR METERS

...makers of precision watthour meters for over forty years

ght View from TWA Plane

THE MODERN METER FOR THE MODERN LOAD

When Laytex-insulated wire first reached New Guinea, the natives were puzzled about its purpose. So were the inhabitants of other lands—from the Solomons to Mongolia.

For Laytex has gone into many, many regions where no wire had ever gone before. Under arctic cold, steaming tropic heat, the shattering shock of heavy explosions, Laytex performs better than was ever expected of any wire.

The entire output of Laytex Wires and Cables goes to fill the needs of war. But in a not-too-distant future the advantages of Laytex will be available for a long list of important home services... Buildings, Police and Fire Alarms, Communications, Signalling, Power, Control, and many more.

Rubber Insulation at Its Best

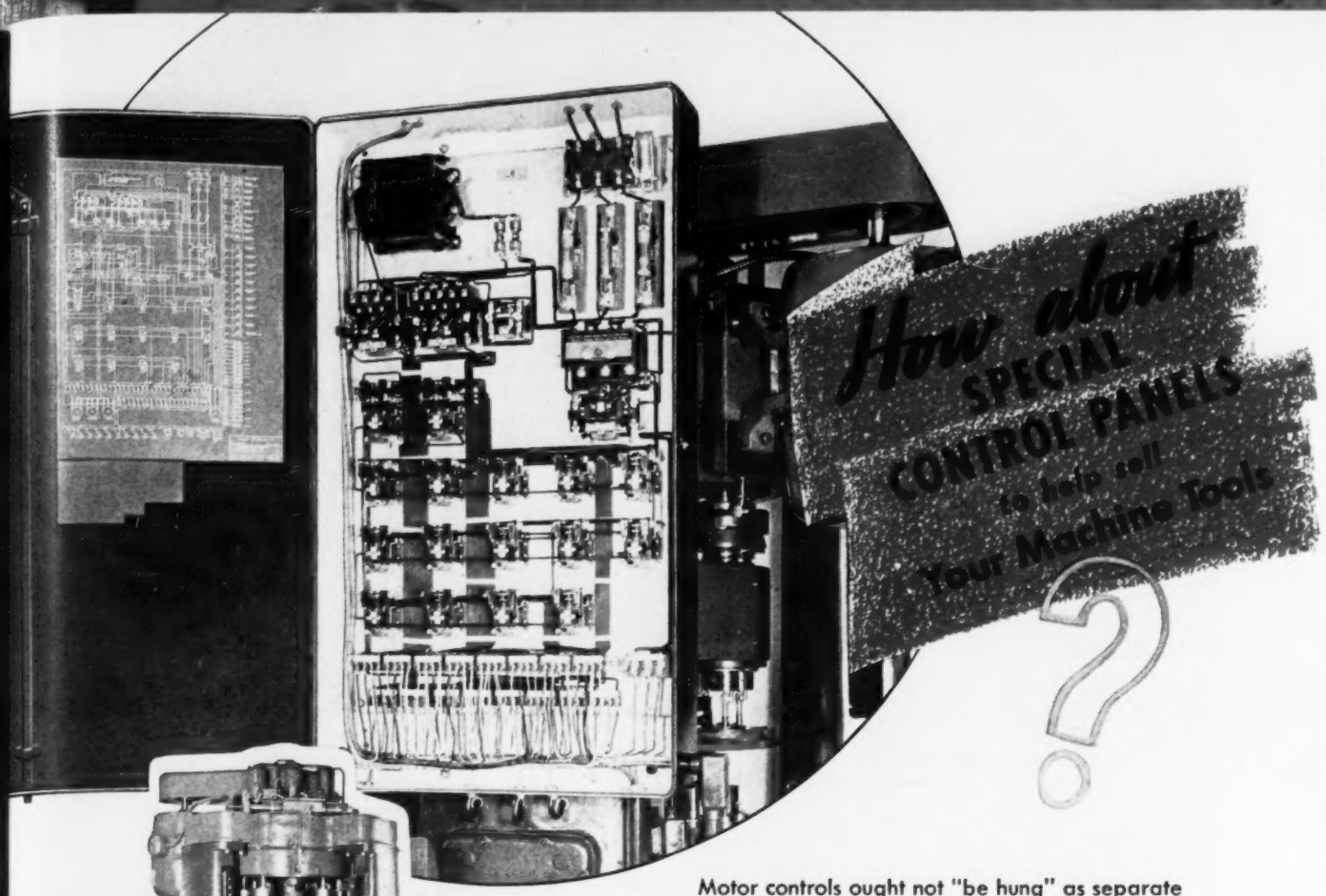
U.S. Laytex

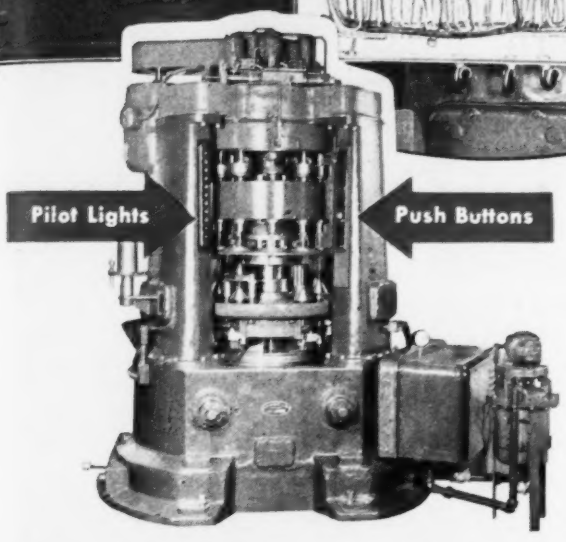
ELECTRICAL WIRES AND CABLES

Serving Through Science

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE, ROCKEFELLER CENTER, NEW YORK 20, N. Y. • *In Canada:* DOMINION RUBBER CO., LTD.





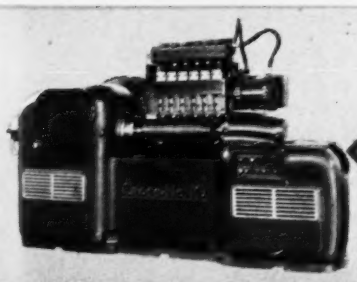
Motor controls ought not "be hung" as separate items on your "up-to-date" machine tool—as an afterthought. Instead, give yourself the sales advantage of complete control assembly . . . like the panel shown above . . . designed to your special requirements, but assembled from standard parts by Allen-Bradley. The appearance of your machine will be improved—its correct sequence operation will be assured, because the panel will be correctly "wired" by specialists.

Allen-Bradley engineers will gladly study your control needs and submit a panel layout for your consideration. Write, today!

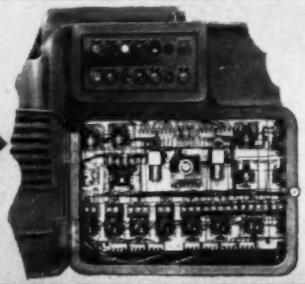
Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.

Leading Machine Tool Builders Use A-B Control Panels

built to their individual specifications from standard starters, contactors, and relays



This lathe, made by the Cross Co., is a typical example of a modern machine tool with the Allen-Bradley control panel built into the machine base. Note also the neat push button and pilot light control board above panel.



ALLEN-BRADLEY

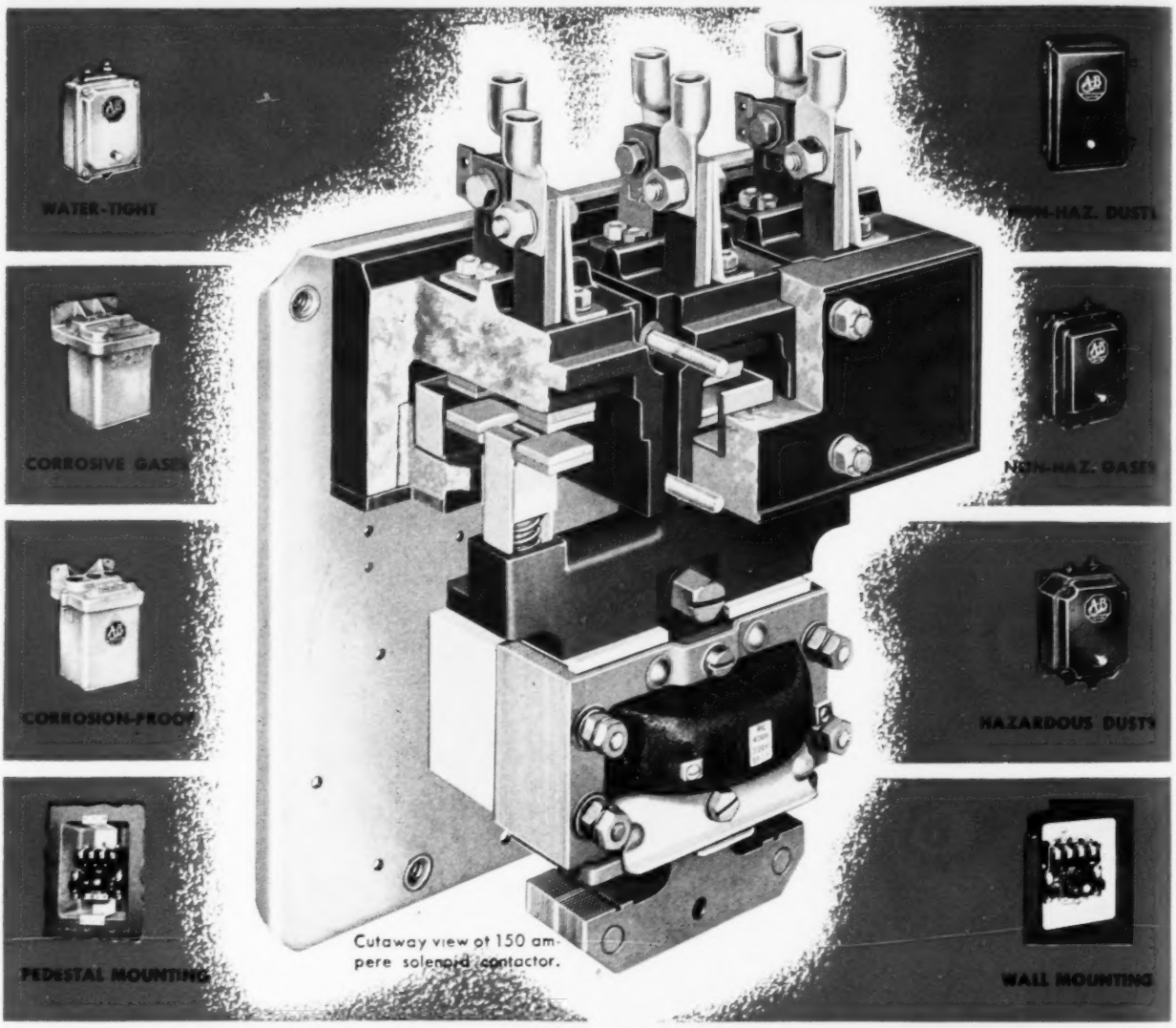
SOLENOID MOTOR CONTROL

QUALITY

Believe it or not...

You must never clean, file, or dress the contacts of Allen-Bradley solenoid starters . . .

ENCLOSURES FOR EVERY SERVICE



Cutaway view of 150 ampere solenoid contactor.

NO TROUBLE WITH CONTACTS

A-B patented silver alloy contacts are good for millions of operations without attention. Just install A-B starters . . . and forget them.

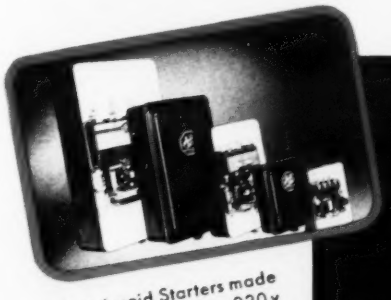
NO TROUBLE WITH STICKING PARTS

A-B solenoid starters have no pins, pivots, or bearings to corrode and stick . . . no flexible jumpers to break . . . no maintenance required.

NO TROUBLE WITH OVERLOADS

A-B overload relays are accurate and dependable. Long periods of idleness do not alter their performance. Specify A-B . . . and be safe.

Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.



A-B Solenoid Starters made in 5 sizes up to 50 hp, 220 v . . . 100 hp, 440-550-600 v.

A-B

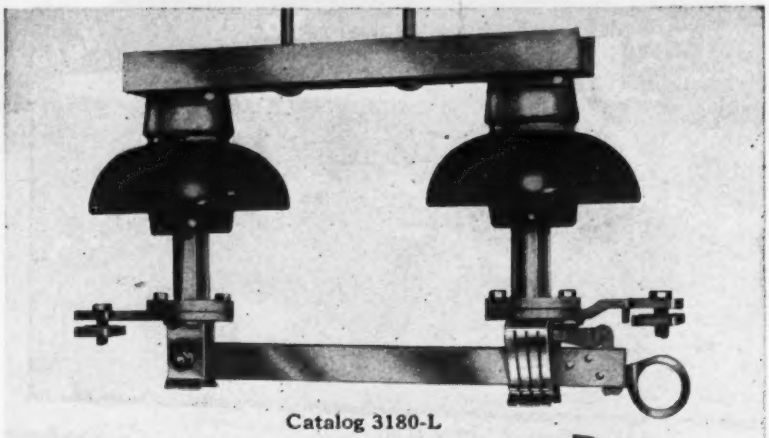
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

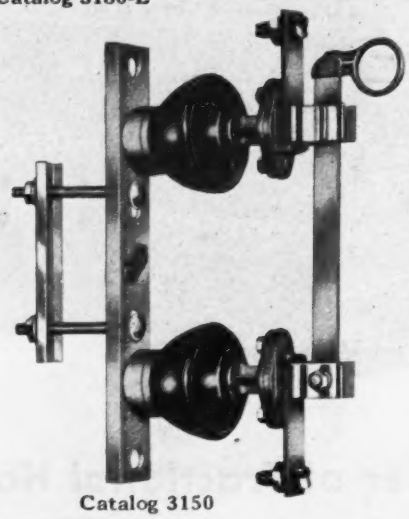
QUALITY

OPEN TYPE
MATTHEWS DISCONNECTING SWITCHES

Adaptable for Horizontal or Vertical Mounting



Catalog 3180-L

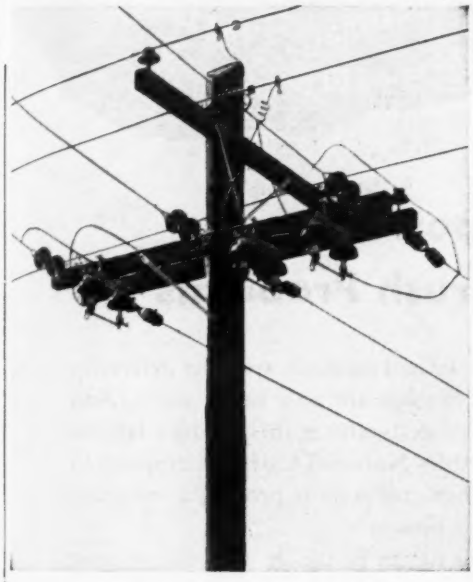


Catalog 3150

High Quality Materials Mean Lowest Time-Cost

•

No Radio Interference at Rated Voltage



Shows installation of Catalog 3158 Matthews Disconnecting Switches.

Matthews Disconnecting Switches are made in 200 and 400 Ampere sizes and 7.5, 15 and 23 Kv. Ratings.

Write for Bulletin 106
It gives complete information.

Where cost of equipment is limited due to low revenue lines, these low-cost, substantially constructed, hot stick operated Matthews Disconnecting Switches will meet your needs for economical and efficient operation.

Special insulators of our own design, have ample electrical values for their respective ratings in accordance with NEMA Distribution CUTOUT Standards, Publication 38-53. Galvanized certified malleable iron caps and pins are securely cemented onto insulators in accordance with our 96-hour natural cement curing process which has given perfect satisfaction in the field for over twenty years.

All current carrying parts are of at least 85% copper content material; all other metal parts are hot galvanized.

The 200-ampere Disconnecting Switches are equipped with single, heavy bus bar copper blades, while the switches rated 400 amperes have double blades. All can be furnished with blade latches, as illustrated, at additional cost.

Female contact clips of bus bar copper, reinforced by spring phosphor bronze retainer clips, assure positive contact with no overheating, at full rated load.

W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

How To Be an "ESOFHMBP"*

*Expert Solver of Fractional Horsepower Motor Brush Problems

FIRST you build, staff and equip a complete laboratory for the purpose. Next, make available to it all the experience and knowledge gained from a half century of brush manufacturing. Then, we believe, you can give our type of brush testing service.

Others, it seems, agree. For more and more electric motor manufacturers are submitting their *present* and *postwar* models to our Fractional Horsepower Motor Brush Testing Laboratory for brush recommendations.

Thanks to recent improvements in our manufacturing facilities and methods, speedier deliveries of "National" brushes are now being made. And helping to speed deliveries is this modern laboratory which enables National Carbon Company to recommend brush grades more promptly and accurately than ever before.

We urge you to get in touch with our nearest Division Office for full information on how to submit motors for brush testing under *your own* specified load, temperature, humidity, altitude or other conditions.

The word "National" is a registered trade-mark of National Carbon Company, Inc.

KEEP YOUR EYE ON THE INFANTRY . . .
THE DOUGHBOY DOES IT!

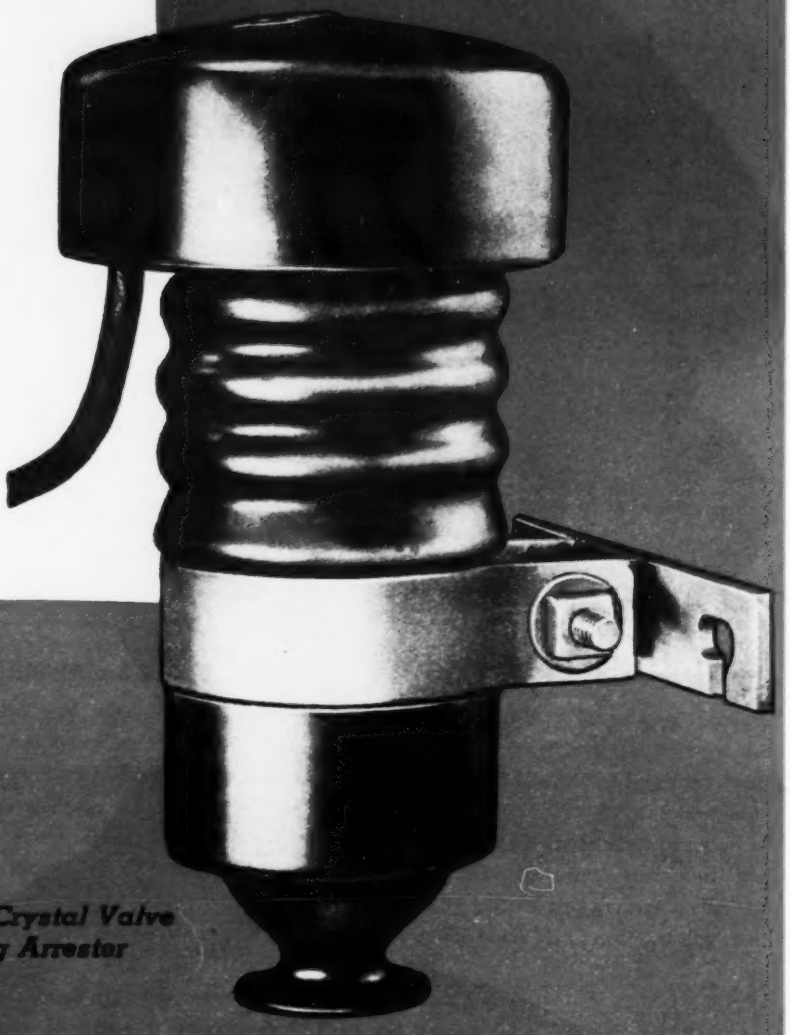
NATIONAL CARBON COMPANY, INC.
Unit of Union Carbide and Carbon Corporation

UCC

General Offices: 30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

You get all of the added advantages and characteristics of a definitely outstanding Valve Element, Oxidized Silicon Carbide (Used only in C.V.'s)



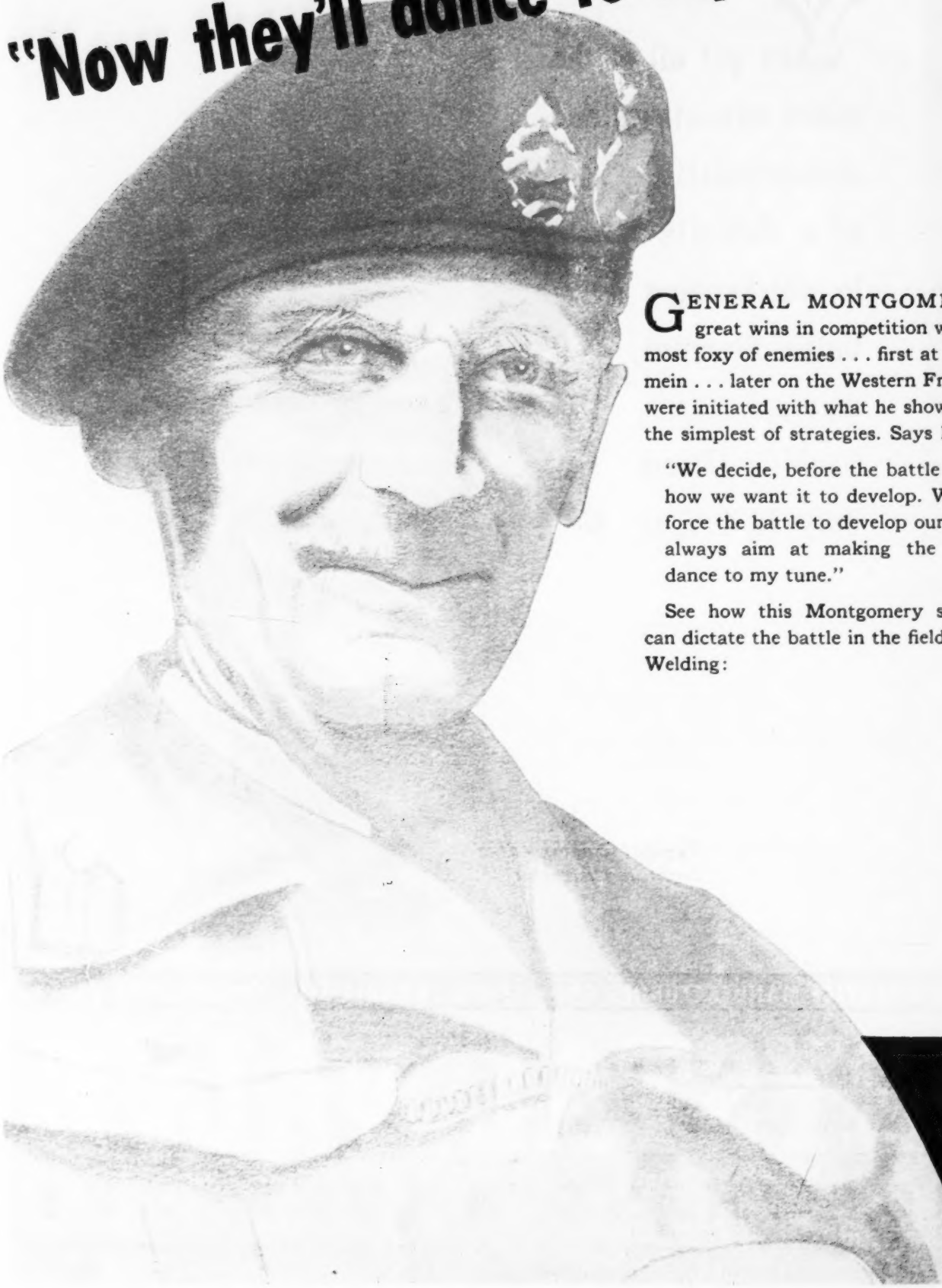
Typical Crystal Valve Lightning Arrester

ELECTRIC SERVICE MANUFACTURING CO. • 17th & CAMBRIA STS., PHILADELPHIA 32, PA.

CRYSTAL VALVE
LIGHTNING ARRESTERS

then he said to himself

"Now they'll dance to my tune"



GENERAL MONTGOMERY'S great wins in competition with the most foxy of enemies . . . first at El Alamein . . . later on the Western Front . . . were initiated with what he shows to be the simplest of strategies. Says he:

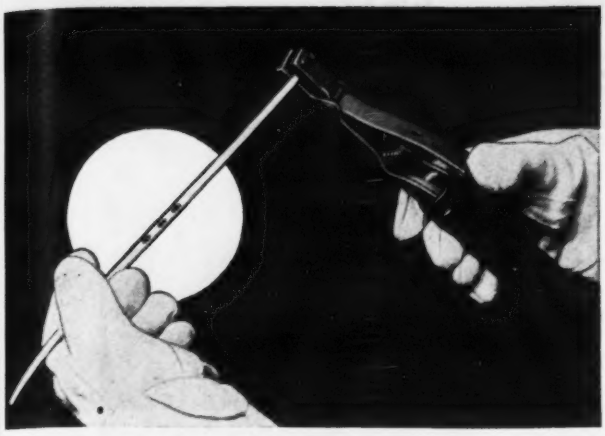
> "We decide, before the battle begins, how we want it to develop. We then force the battle to develop our way. I always aim at making the enemy dance to my tune."

See how this Montgomery strategy can dictate the battle in the field of Arc Welding:

"Force the Battle," *he says*

LOOK, GENERAL, how manufacturers and builders force their "enemy" competitors to dance to the tune of faster and better Arc Welding.

with

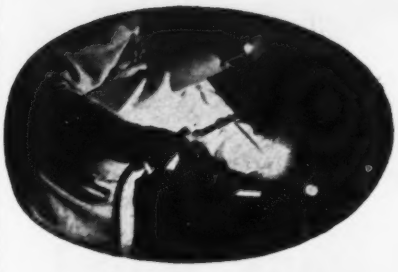


"FLEETWELD"

. . . the world's No. 1 electrode family

THREE DOTS

Enables you to identify at a glance the genuine "Fleetweld"

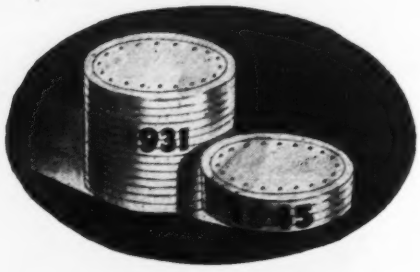


FORCE 1: FASTER and FASTER WELDING

Lincoln Engineers, in constant touch with welding users the world over, provide a fund of ideas for the continuous improvement of "Fleetweld" and the techniques for its use. Result: Deposit rates are faster; spatter and slag loss is less; arc is easier to strike and maintain under all welding conditions and positions.

FORCE 2: HIGHER and HIGHER QUALITY

Every "heat" of wire, every batch of chemicals and every step in "Fleetweld" production is checked carefully by laboratory and production supervisors to make sure that every electrode meets super strict specifications. Continuous refinement of "Fleetweld" has kept it the standard of weld quality the world over.



FORCE 3: LOWER and LOWER COST

Lincoln's increasing large-scale production has made possible installation of the world's most efficient equipment and methods for electrode manufacture. Lincoln has led the world in the reduction of electrode manufacturing cost and has continually passed the savings on to the user . . . for lower and lower welding cost.

Complete details and procedures for eight types of "Fleetweld" and 32 other Lincoln Electrodes are given in the "Weldirectory." Free on request.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

DEEP COMPRESSION MOLDING with MEGATHERM* Electronic Heat

They said it couldn't be done — but the Kuhn & Jacob Molding & Tool Company of Trenton, New Jersey did it . . . *with Megatherm!*

All previous attempts to compression-mold this heater-coupling with ordinary methods of preform heating, had resulted in rejection ratios as high as 99 to 1. Because of its large size, irregular shape, and variable thickness, it posed a difficult production problem.

But the high-speed uniform heating of the rag-filled resin-bonded preform with Megatherm electronic heat resulted in flawless finished couplings with a smooth surface and minimum flash that passed rigid inspection tests 100%.

Here is another proof that Megatherm can do the job better . . . not only in production problems involving large parts, irregular shapes, and variable thicknesses, but in run-of-the-mill operations.

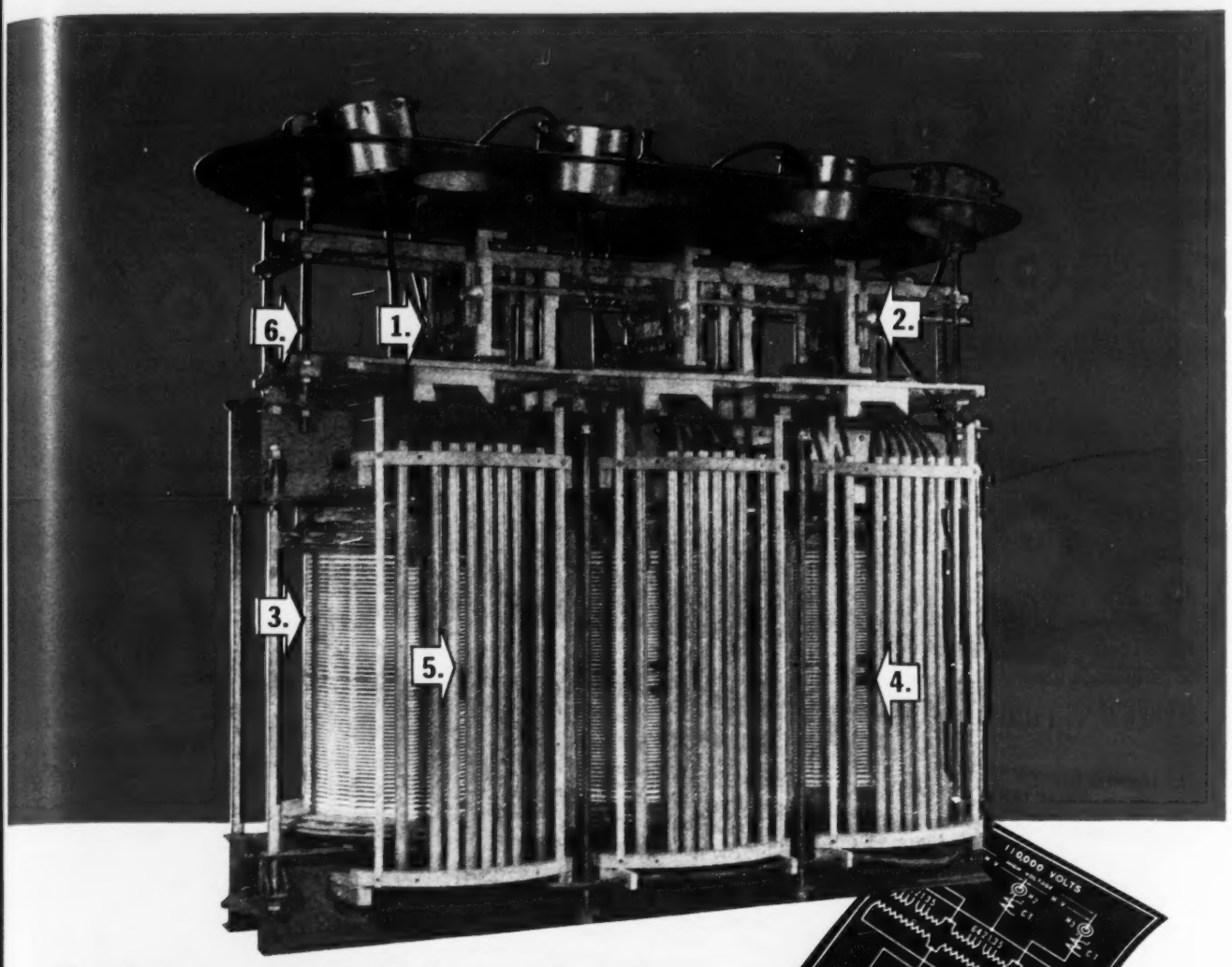
And as a result, more and more plastic processors are installing Megatherm . . . the modern tool for modern industry. Get the story on Megatherm now.

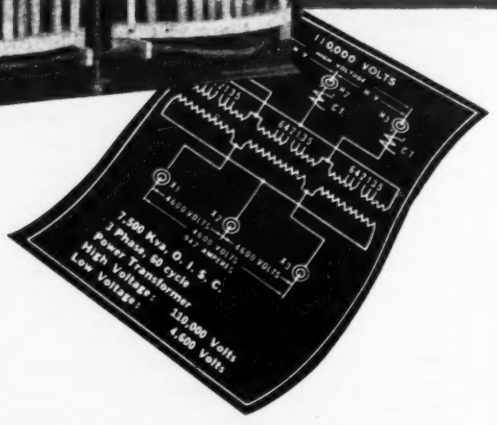
Federal Telephone and Radio Corporation

*Reg. U. S. Pat. Office

INDUSTRIAL ELECTRONICS DIVISION

Newark 1, N. J.





Features you look for and get in *Pennsylvania* Power Transformers!

1. Straight-line Tap Changers with Silver to Silver Contacts easily accessible for inspection and cleaning through manholes in cover.

2. The tap changers of the three phases are operated by a common shaft which issues through the side of the tank and can be operated from the floor, if desired. Static shields are provided on tap changers on all high voltage transformers.

3. Before the coils are placed on the core, they are subjected to hydraulic pressure greater than the stresses encountered in service under the most severe short-circuit conditions. This insures the ability of the transformer to withstand short-circuits with safety.

4. The regulating taps are located in such places of the winding as to cause a minimum of unbalancing. Each tap is made at an outside cross-over connection between pancakes, thus leaving the spaces between coils free for oil circulation and providing better insulation and clearances for tap leads.

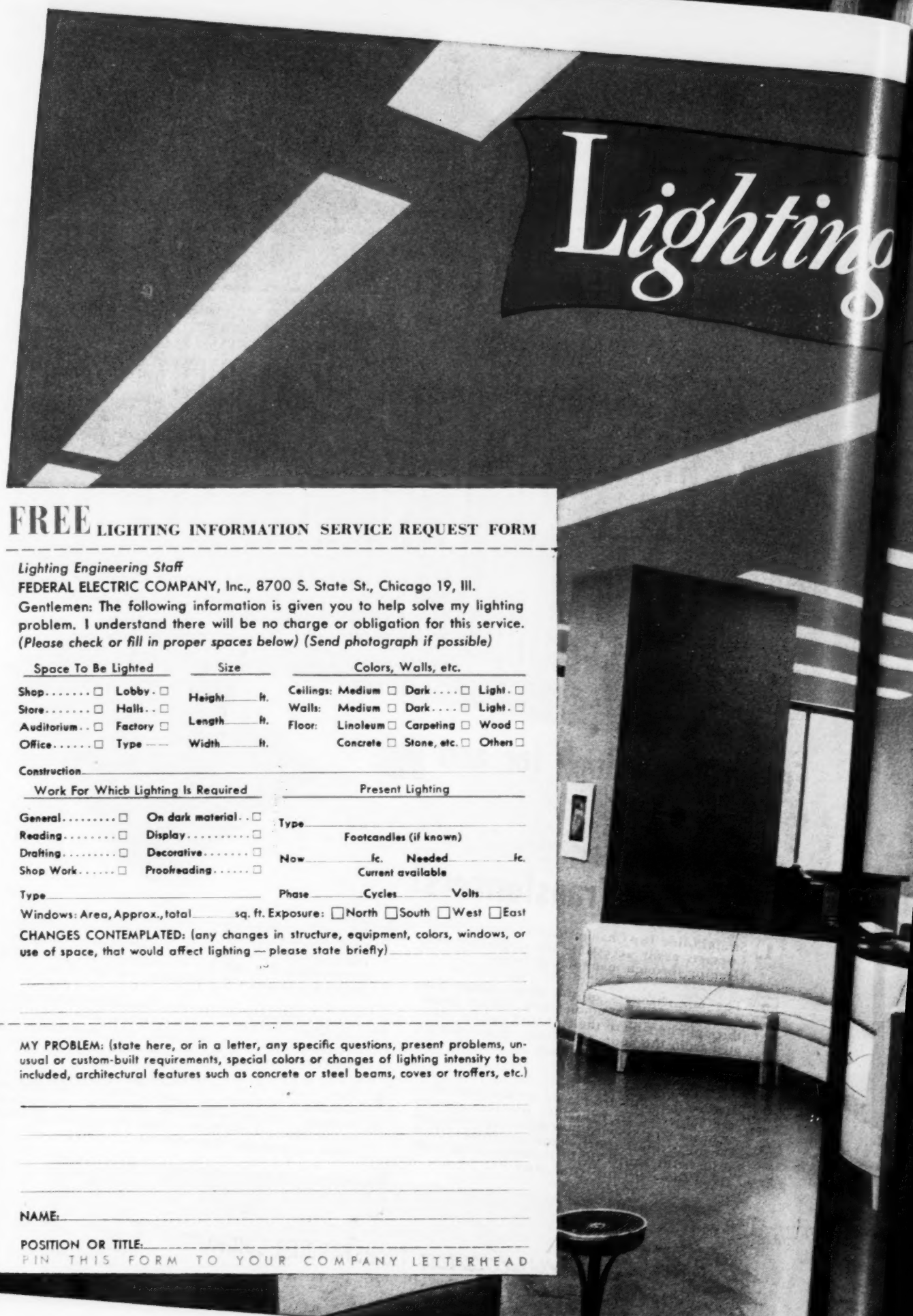
5. The line and tap leads consist of heavily insulated cables supported by stiff insulating tubes, thus providing a rigid support for the leads and preventing any possible distortion and damage during short-circuits.

6. Core, coils, cover and bushings form an assembly which can be lifted as a unit, and which permits untanking without disturbing electrical connections inside the transformer. Four heavy rods provide solid support for the cover and bushings.

Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, N. S., PITTSBURGH 12, PA.

Pennsylvania TRANSFORMERS



FREE LIGHTING INFORMATION SERVICE REQUEST FORM

Lighting Engineering Staff
FEDERAL ELECTRIC COMPANY, Inc., 8700 S. State St., Chicago 19, Ill.
Gentlemen: The following information is given you to help solve my lighting problem. I understand there will be no charge or obligation for this service.
(Please check or fill in proper spaces below) (Send photograph if possible)

Space To Be Lighted

Shop..... ☐ Lobby.. ☐
Store..... ☐ Halls.. ☐
Auditorium.. ☐ Factory ☐
Office..... ☐ Type ——

Size

Height____ft.
Length____ft.
Width____ft.

Colors, Walls, etc.

Ceilings: Medium ☐ Dark.... ☐ Light.. ☐
Walls: Medium ☐ Dark.... ☐ Light.. ☐
Floor: Linoleum ☐ Carpeting ☐ Wood ☐
Concrete ☐ Stone, etc. ☐ Others ☐

Construction____

Work For Which Lighting Is Required

General..... ☐ On dark material.. ☐
Reading..... ☐ Display..... ☐
Drafting..... ☐ Decorative..... ☐
Shop Work..... ☐ Proofreading..... ☐

Type____

Present Lighting

Type____
Footcandles (if known)
Now____fc. Needed____fc.
Current available
Phase____Cycles____Volts____

Windows: Area, Approx., total____sq. ft. Exposure: ☐North ☐South ☐West ☐East

CHANGES CONTEMPLATED: (any changes in structure, equipment, colors, windows, or use of space, that would affect lighting — please state briefly)____

MY PROBLEM: (state here, or in a letter, any specific questions, present problems, unusual or custom-built requirements, special colors or changes of lighting intensity to be included, architectural features such as concrete or steel beams, coves or troffers, etc.)

NAME:____

POSITION OR TITLE:____

PIN THIS FORM TO YOUR COMPANY LETTERHEAD

HAVE YOU TAKEN ADVANTAGE OF THIS NEW FEDERAL ELECTRIC CO. SERVICE?

Information Service

ZEON COLD CATHODE FLUORESCENT LIGHTING

Many new lighting installations are now being planned. Most of them will use fluorescent lighting. This lighting is still new to many people. It is important to the user, and to the lighting industry, that these new installations are so designed that they give the full benefit of the glareless illumination, flexibility, and economy of fluorescent lighting. Therefore Federal Electric Company, Inc. offers its help, and the counsel of its lighting engineers, through *Lighting Information Service.*

This company offers to share, freely, with any prospective user, or his architect, consulting engineer, and electrical contractor, the benefit of its 15 years' experience in the manufacture of gaseous discharge lamps and in designing lighting installations. Take advantage of this service. Fill in the form below; or, if you prefer, describe your problem in detail in a letter. Our engineering staff will make a sincere effort to help you with your plans, so that you get the best possible results from whatever fluorescent lighting you install.

DID YOU KNOW THAT THERE ARE 2 KINDS OF FLUORESCENT LIGHTING?

"Hot Cathode" is the common heater filament type of fluorescent lamp; "Cold Cathode" is the improved shell-electrode type, of which Zeon is the outstanding example. Long life, lower maintenance cost, greater flexibility are some advantages of Zeon Cold Cathode Fluorescent Lighting.

HOW THIS SERVICE CAN HELP YOU. **Federal Electric Company, Inc. Lighting Engineers will study your problem. They may write you for additional information, or may call on you.**

After a complete analysis, they will recommend the type and amount of fluorescent lighting required, best location and type of fixtures, wiring, connections, load, and any other equipment or changes recommended.

This service does not replace that of the architect, consulting engineer, or electrical contractor, but is simply specialized advice to them or to you. There is no charge for this service, and no obligation, other than your cooperation in giving us full information needed for a sound recommendation.

WHAT IS YOUR PROBLEM? **Do you want help in planning a job, advice on the amount, type, and color of illumination? Perhaps you would simply like to have us check your plans. We will be glad to help you. Federal Electric Company, Inc. does not install lighting equipment, but sells it to contractors and wholesalers—and is glad to assist them in securing successful installations.**

FEDERAL ELECTRIC COMPANY, INC.

LIGHTING (F) DIVISION

8700 S. STATE ST., CHICAGO 19, ILL. TELEPHONE VINCENNES 5300

225 N. MICHIGAN AVE., CHICAGO 1, ILL. TELEPHONE STATE 0488

SUBSIDIARY COMPANY . . . FEDERAL BRILLIANT COMPANY, ST. LOUIS, MO.

Branch Offices: Cincinnati • Dallas • Duluth • Houston • Indianapolis • Kansas City • Louisville • Milwaukee Minneapolis • New Orleans • New York • Philadelphia

With BULLDOG BUStribution DUCT

you can get increased capacity, flexibility, completeness, through this wide variety of Circuit Protective Plugs

VACU-BREAK SWITCH PLUG

Fusible and non-fusible, 30 to 800 amp., 2 or 3 pole, 575 volts or less, or 4 pole solid neutral 230 volts A.C. H.P. rated.

TYPE "FB" BUS PLUG

Cover operating types, in 30, 60 or 100 amp. Horsepower rated. Fusible and non-fusible, 575 volts or less.

CIRCUIT BREAKER PLUG

For use where an automatic protective device is required, with either rigid or flexible conduit — max. capacity, 600 amp., 600 volts.

CIRCUIT MASTER PLUG

Designed for single pole circuits for 120 volts and 2 pole for 240 volts, 15 to 30 amp.

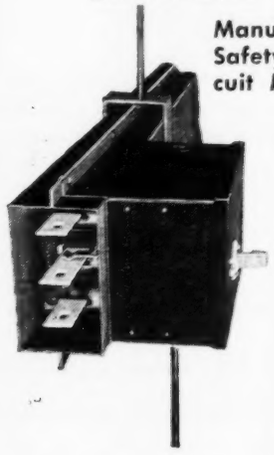
The wide variety of pre-fabricated circuit protective tap-off plugs available for use with BUStribution DUCT is just another example of the thoroughness of BullDog engineering.

Built for every circuit protective purpose, BullDog Standard Bus Plugs give you both increased capacity and complete flexibility for rearrangement of production machinery. Additional outlets can be installed quickly and inexpensively—change-overs can be made in minimum time, with minimum labor cost and no material loss.

All Bus Plugs fasten securely to the flanges of the duct section at the plug-in openings, may be mounted on either or both sides of the duct and require no auxiliary screw clamps or fittings. Engagement with the bus bars is made through spring reinforced contact fingers so designed that accidental contact with live parts is impossible.

For complete information on the various BullDog Bus Plugs illustrated in this advertisement, write for our illustrated bulletin 427-2.

Manufacturers of a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Breakers and BUStribution SYSTEMS.



MOUNTED PLUG

This end view of a plug mounted on duct shows how the copper "contact" fingers of the plug clamp over the bus bars in the duct.

Speed Victory — Buy More War Bonds!

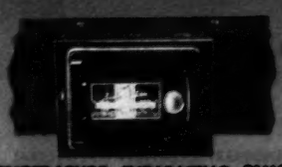
BULLDOG

ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN

BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

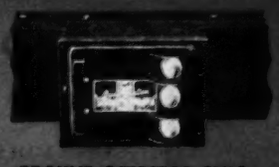


TEMPERATURE INDICATING PLUG

When temperature of bus bar exceeds 105° C. (212° F.) (30° C. ambient plus 75° C. rise), lamp automatically lights.

CAPACITOR PLUG

Convenient and flexible means for improving Power Factor. Available from 1 to 15 K.V.A., 220 or 440 volts, 60 cycle A.C.



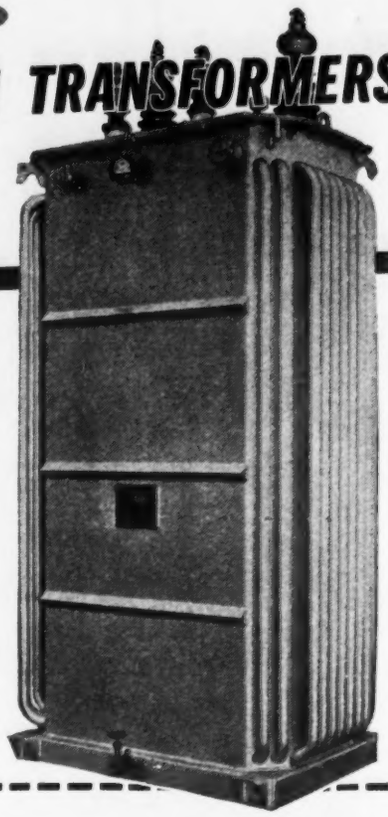
GROUND DETECTOR PLUG

7½ watt automatic resetting-thermistor lamps provide visual indication for lowering pressure or ungrounded

Wagner

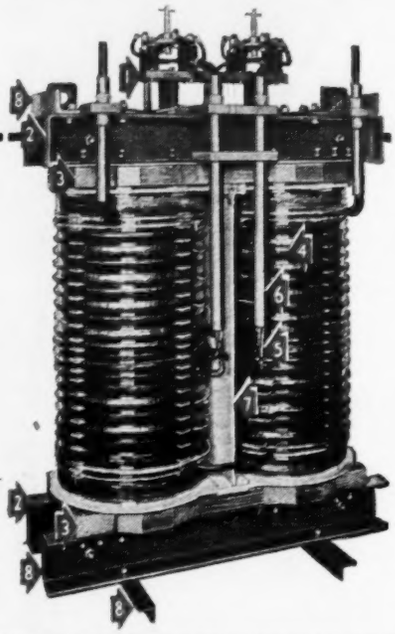
Single-Phase DISTRIBUTION TRANSFORMERS

provide a *plus* combination of superior characteristics . . .



Thousands of Wagner transformers are winning their "service stripes" under the heavy stress of present wartime loads. Wagner transformers have a fine reputation for being able to stand up in service—and there are many reasons, too many to list in the space limitations of a single advertising message.

The features listed below are but a few of many reasons why Wagner transformers stay on the job under the severe operating conditions to be encountered today.



1 Tap-changers are mounted on fully-seasoned, vacuum-dried, oil-treated maple supports—to provide high dielectric and mechanical strength with proper alignment.

2 Top and bottom endplates and associated parts are made up of fabricated structural steel forms rigidly bolted together. All nuts are locked in place by means of pal-nuts or other approved shakeproof devices.

3 Coil-clamps of oil-treated maple effectively clamp the coils and prevent distortion under operating conditions.

4 High-voltage single-division coils are separated from each other by insulating washers.

5 Taps are brought out in the middle of the winding where they offer no real problem as far as weakening coils and causing breakdowns.

6 Tap-leads are grouped together and carried thru insulating tubes to the terminal-board or tap-changer. This procedure mechanically supports the leads in the space necessary for proper electrical clearances.

7 Barriers of heavy pressboard between the two legs of the windings prevent flashover.

8 The element is securely braced against horizontal and vertical shifting. The lower clamping members are extended to the dimensions of the tank; the top members are anchored to the tank walls.

Low-voltage cylindrical-type coils are amply provided with oil-ducts passing through their entire length, assuring effective cooling throughout the winding. An insulating cylinder supplemented by an oil-duct on each side provides insulation between the high-voltage and the low-voltage coils.

TRANSFORMERS
are but one of several WAGNER PRODUCTS serving industry.

Other WAGNER PRODUCTS:

AIR BRAKES
·
BRAKE LINING
·
HYDRAULIC BRAKES
·
INDUSTRIAL BRAKES
·
INDUSTRIAL BRAKE CONTROLS
·
TACHOGRAPH
(Recording Speedometer)
·
ELECTRIC MOTORS

THESE 29 SALES AND SERVICE BRANCHES ARE READY TO SERVE YOU

For complete information on Wagner distribution transformers (or other types of Wagner transformers such as power, air-cooled, substation, rural-line, etc.) write to the address below or to the nearest of these 29 branches manned by trained field engineers who are ready to help you solve your transformer problems:

ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 • CINCINNATI 10
CLEVELAND 15 • DALLAS 1 • DENVER 2 • DETROIT 2 • HOUSTON 2 • INDIANAPOLIS 4
KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3 • MILWAUKEE 2 • MINNEAPOLIS 4
NEW YORK 7 • OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9 • ST. LOUIS 3
SALT LAKE CITY 1 • SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5

A 6-6

Wagner Electric Corporation

ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

EXTENSIVE STOCKS OF FIBERGLAS

Electrical Insulation TAPES

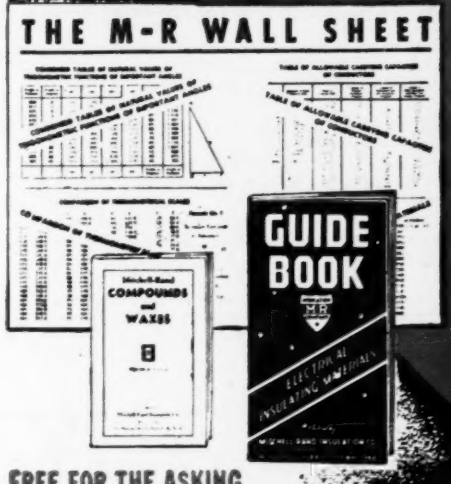
are available at M-R *"Electrical Insulation Headquarters"* FOR IMMEDIATE DELIVERY and Complete Protection of your Electrical Equipment

Overloading . . high or low temperatures . . moisture . . . corrosive acids, vapors or fumes . . oils . . greases . . dust or dirt, the destructive elements of ordinary electrical insulations WON'T AFFECT M-R FIBERGLAS INSULATION.

The success story of Fiberglas Insulation abounds with fewer breakdowns, less maintenance, elimination of waste, savings in labor and materials and proves its value as the optimum in electrical insulation protection.

Widths range from ⅜ to 1½ inches; Thicknesses: .003"-.005"-.007" and .010".

Tensile Strength: extraordinary—example—tape ½" wide and .003 thick—80 pounds. Fiberglas tapes, because they are greater in tensile strength, should be specified one size thinner than other makes.



FREE FOR THE ASKING

"Write today for your Free Card of Varnished Tubing with samples ranging from size 0 to 20 to fit wires from .032 to .325 inches . . . other valuable aids, are the M-R Guide Book of Electrical Insulation . . . the Wall Chart with reference tables, electrical symbols, allowable capacities of conductors, dielectric averages, thicknesses of insulating materials and tap drill sizes . . . and the M-R Wax and Compound Guide Book . . . they are full of valuable information . . . write for them on your letterhead.

Obtain your Fiberglas Electrical Insulation from

MITCHELL-RAND

Write for booklet describing Fiberglas and its electrical insulation uses and properties.

MITCHELL-RAND for 56 YEARS THE ELECTRICAL INSULATION HEADQUARTERS

MITCHELL-RAND INSULATION COMPANY, INC.

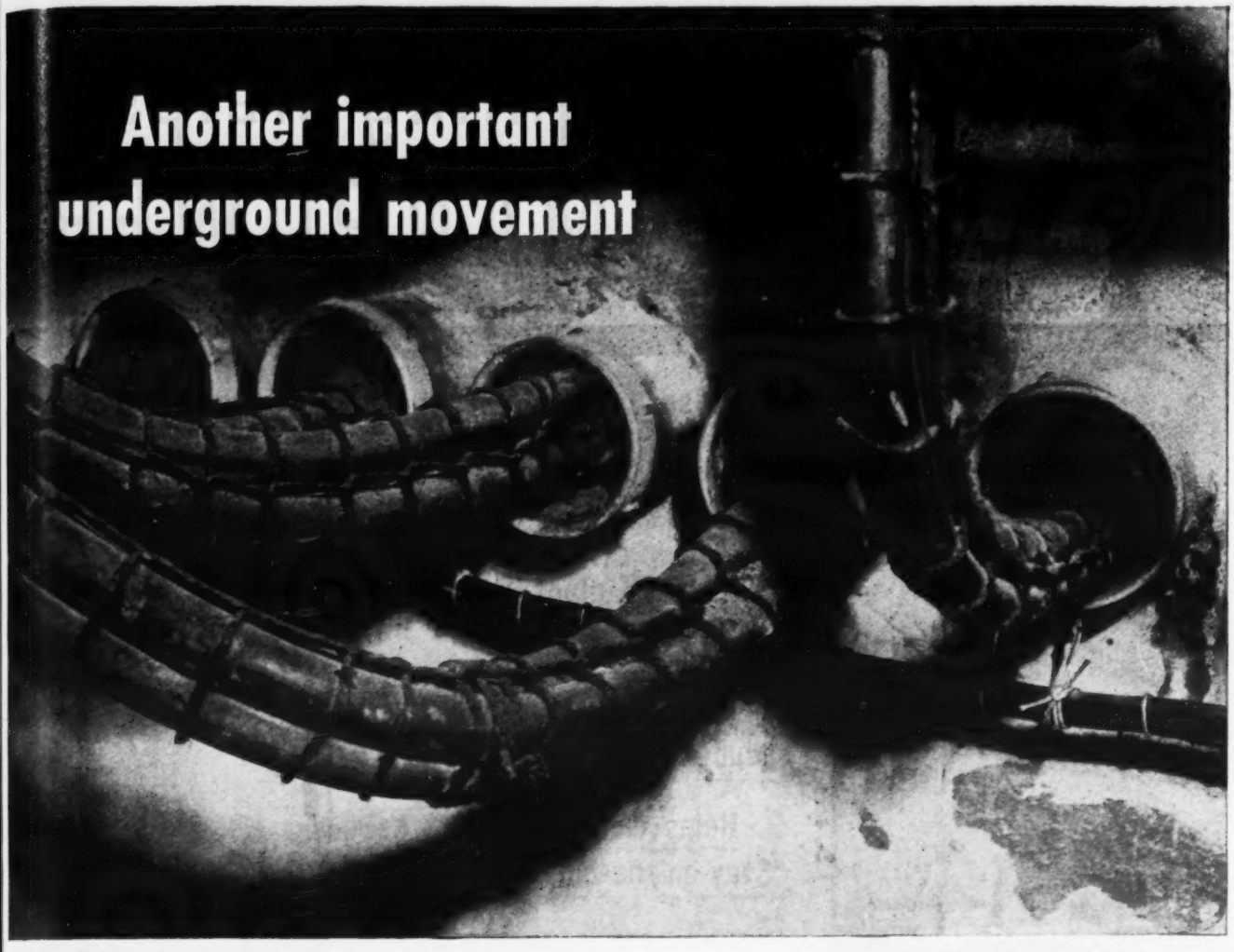
51 MURRAY STREET COrtlandt 7-9264 NEW YORK 7, N. Y.

A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds

Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing



Unsheathed buried power cable insulated with Geon

THOSE large power cables represent an important development in the electrical industry. As they pass through the basement wall, they go directly into the earth. There the thinner-than-usual coating of GEON insulation will, without benefit of lead sheathing, resist the effects of the soil's acids and alkalies, will keep out moisture—*while its excellent electrical properties will be maintained.*

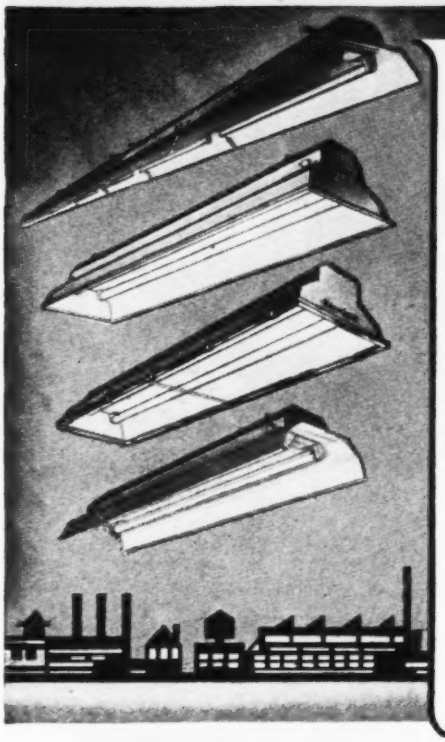
On the other extreme, GEON polyvinyl materials have been made into thousands of miles of fine "spaghetti" to slip on radio and switchboard wire. Through the entire range of wire and cable insulation GEON'S unusual properties have made possible a wide variety of applications. In addition to possessing fine electrical properties, GEON resists oils, acids, water, flame, heat, cold. It's practically wearproof. It's smooth—permits easy handling and installation. Thinner coatings of insulation mean more conductors per conduit. GEON can be brilliantly colored in the entire NEMA range for easy, positive identification.

Urgently needed for military uses, all the GEONS are subject to allocation by the War Production Board. Limited quantities are available for experiment, and our development staff and laboratory facilities will help you work out special problems or applications. For more complete information write Department CC-3, Chemical Division, The B. F. Goodrich Company, 324 Rose Building, Cleveland 15, Ohio.

CHEMICAL DIVISION
The B. F. Goodrich Company
ROSE BUILDING • CLEVELAND 15, OHIO

Geon
Polyvinyl Materials

How "RIGHT" Lighting Helps CONSERVE MANPOWER



In these 3 Ways...

"RIGHT" LIGHTING as provided by properly applied Benjamin Lighting Equipment is helping Industry to meet today's pressing manpower problems...

1. Protects plant personnel against accidents.

2. Conserves energy and reduces fatigue.

3. Helps older employees to "Stay-on-the-Job"

PROMOTES SAFETY. The influx of new, inexperienced men and women, many of whom are unaccustomed to industrial occupations and the increase in the average age of the working force accentuates need for maximum accident protection. Further, demands for sustained, high speed production and day and night shifts have increased the *problem of fatigue* as a cause of accidents.

"RIGHT" Lighting is helping in the solution of this aggravated Safety problem in two ways. First, enough light enables the individual to *see hazards easier and more quickly.*° It takes time to see*. The more light, however, the less the time required to see and to act*. The more light, therefore, the fewer accidents!°

Further, "Right" Lighting makes *seeing easier and less tiring.* To secure such lighting requires attention to many details such as the elimination of unshielded or improperly shielded light sources, proper painting of walls, ceilings, machines and working surfaces, and provisions for uniform distribution of the light over the work areas. These and other factors help to increase visibility and thus minimize eyestrain and fatigue*, the enemies of alertness against accidents.

*from I.E.S. report "Value of Good Lighting in War Production"
°from booklet "Plant Efficiency" published by War Production Board

COMBATS FATIGUE. Not only is fatigue the cause of accidents, but also, an important factor in rate and quality of production, absenteeism, health and morale. "Right" Lighting helps solve the fatigue problem by reducing the drain on the worker's reserve energy. For seeing requires energy!* The better the lighting, the less the drain!*

KEEPS OLDER MEN ON JOB! "Right" Lighting benefits the older employee and those with deficient vision of all ages even more than those with normal vision. More light helps compensate for visual deficiencies and the loss of visual acuity due to age. Given this additional light, the manpower represented by this large group can be efficiently utilized for war production.°

• • •

Write for Free Booklet entitled "Productive Lighting" containing much valuable information on how Benjamin Lighting Equipment enables you to obtain "Right" Lighting for your plant. With it will be sent complete information on how to obtain, without cost or obligation, the assistance of a Benjamin Trained Lighting Specialist in analyzing the performance of your lighting and in making recommendations.

BENJAMIN ELECTRIC MFG. CO., Dept. K, Des Plaines, Illinois

BENJAMIN RLM Your Warranty of Uniform Quality

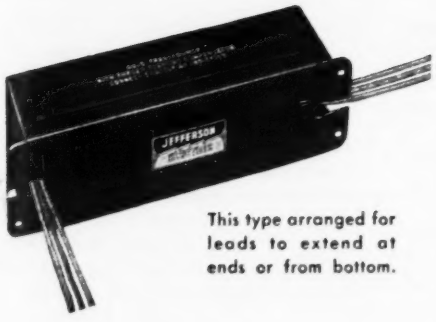
BENJAMIN TRADE MARK
Lighting Equipment
Distributed Exclusively Through Electrical Wholesalers

QUIETNESS

● The quietness of Jefferson Electric Ballasts is an important consideration in most fluorescent lamp installations.

This quiet operation is a result of correct engineering, careful selection of all materials, control of assembly, processing, and inspection—production of every part under Jefferson supervision and under one roof.

Quietness is further evidence of high quality in large scale Ballast production; a Jefferson Electric characteristic recognized by experienced lighting engineers and fixture manufacturers . . . New Bulletin 441-FL contains the latest engineering data. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. *In Canada:* Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ont.



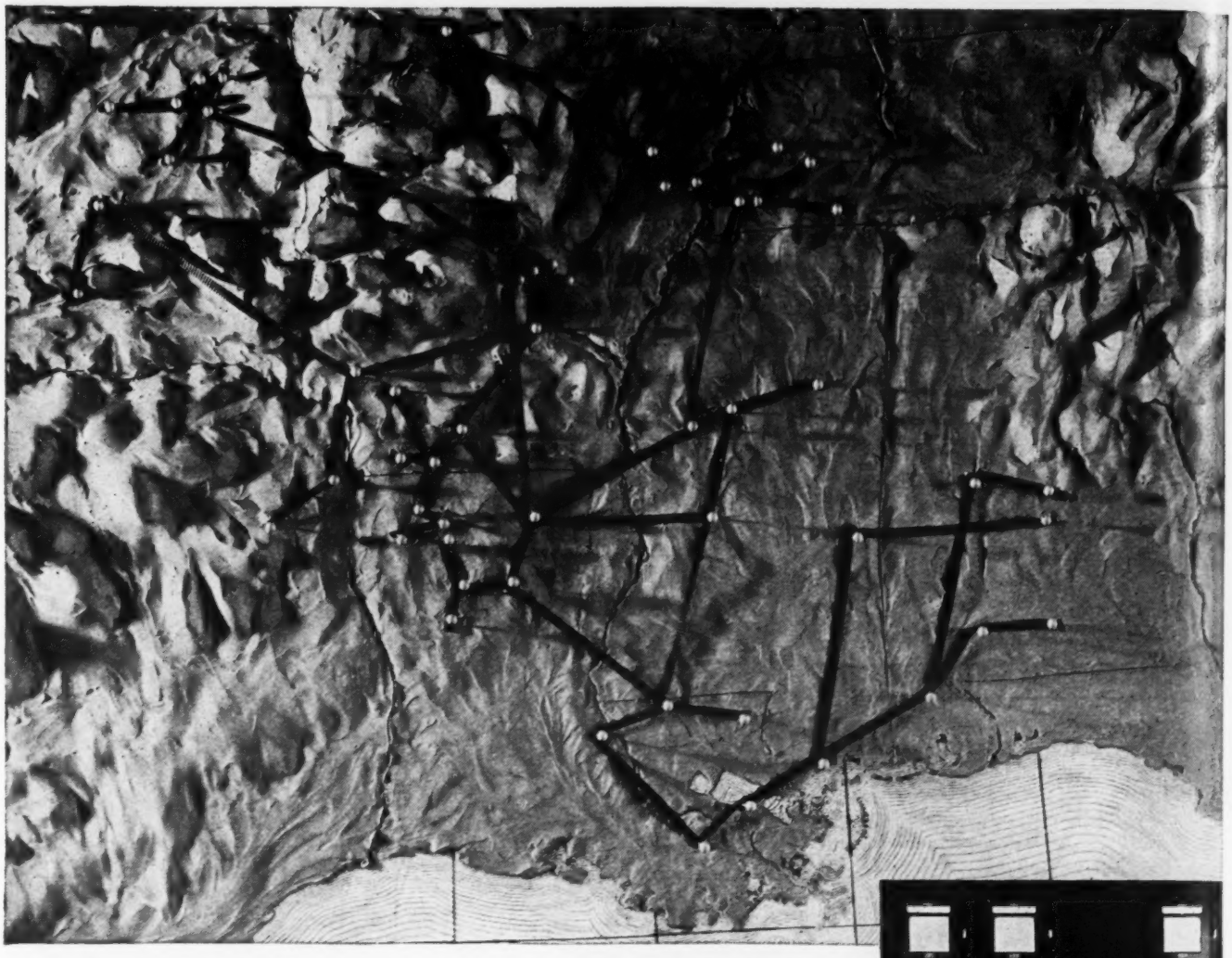
This type arranged for leads to extend at ends or from bottom.

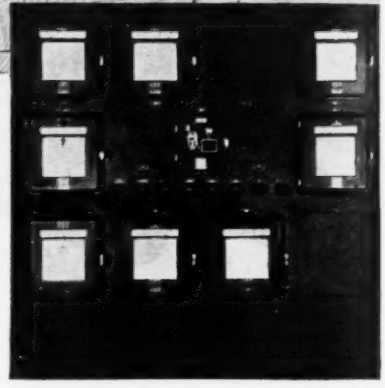
These Ballasts too are approved by the Underwriters' Laboratories, Inc., and have the ETL certification.

Instant Starting Ballasts are now available in two-lamp 40-watt sizes, making starting possible without separate starter action or cathode pre-heating.

JEFFERSON ELECTRIC

FLUORESCENT LAMP BALLASTS





Load Control Panel of ALMNO (Arkansas-Louisiana-Mississippi-New Orleans) power pool's system. Micromax Recorders show load on the tie lines at Ashdown, Markham's Ferry, Memphis and Gulfport, and on any combination of ties. A sixth Micromax records system frequency. Two more record generation at Carpenter and Sterlington Stations, and the remaining instrument operates these stations to maintain load on any tie or ties.

ALMNO Stations Borrow & Lend Power With Help of this L&N Panel

This Panel makes it easier for the power pool's member Companies to carry on the continuous borrow-lend transactions which are the pool's reason for existing.

Installed in the ALMNO load-dispatching office, the Panel has two functions: (1) To keep accurate, instantaneous record of the borrowing-lending of power over each of the tie lines. (2) To maintain the load on any tie or ties by operating the generators in distant stations. In performing this control, the Panel does not merely signal the station; it operates the motor-governor contacts on the individual generator or generators. And any type of control which the operator could thus maintain can be maintained (with greater accuracy) by the Panel.

Only about one-tenth as many telephone calls are necessary, between dispatcher and station, as would be needed if this Panel were not used. This saving in time is of course a great help in the accurate following of load schedules.

L&N Load-Frequency equipment is described in Technical Publication N-56-161(1), sent on request.

Jrl Ad N-56-161(6)

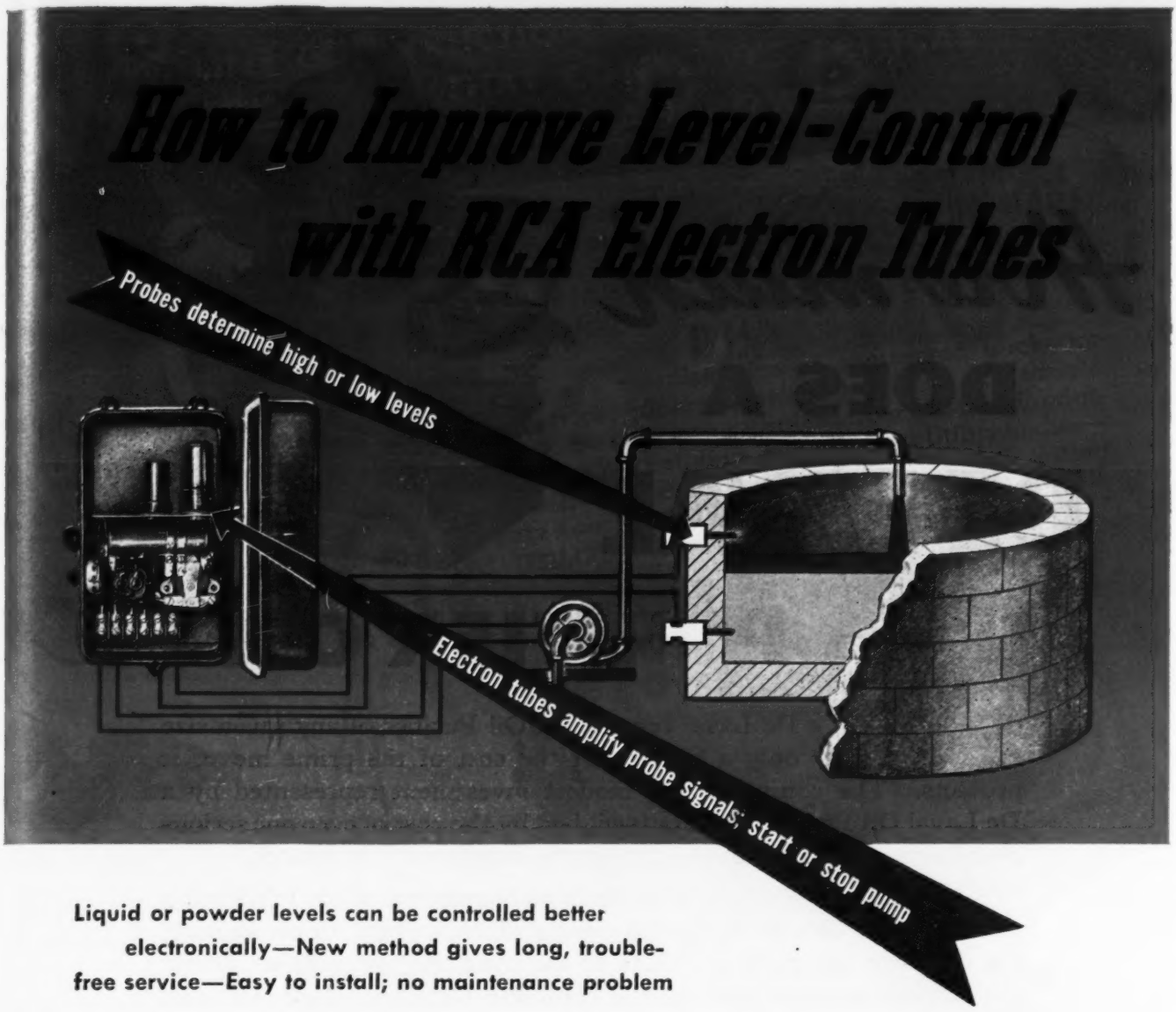
V depends on me!
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4938 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

How to Improve Level-Control with RCA Electron Tubes



Liquid or powder levels can be controlled better electronically—New method gives long, trouble-free service—Easy to install; no maintenance problem

New Electronic Equipment by Photoswitch, Inc. — Equipment developed by Photoswitch Incorporated makes possible precision level-control of all powders or liquids regardless of viscosity, conductivity, combustibility, or temperature —whether corrosive or noncorrosive.

Electronic level-control equipment is now being used in thousands of industrial plants—chemical, food-packing, dairy products, breweries, and every other industry where level-control problems exist.

Applications:

1. Initiate pump, motor, or valve-control at one or more predetermined levels; set off signals and alarms
2. Initiate various pump-programming operations
3. Control the interface between two liquids—such as water and gasoline
4. Control degree of concentration when liquids are being mixed
5. Detect boiler-feedwater contamination

How It Works — For conductive liquids, a metal probe is inserted in the system at the level to be controlled. The probe is connected through a coaxial cable to an electrical circuit. When liquid comes in contact with the probe (or in some cases breaks contact with the probe), a minute current passes through the electrical system. This is amplified by RCA Electron Tubes. The amplified current operates a relay causing the desired operations to be performed—such as operating valves or pumps.

For nonconductive liquids and for powders, a capacitance-type probe is used.

Turn to Electronics for Solution of Your Own Problems — If you are interested in electronic level-control, write to *Photoswitch Incorporated,* Cambridge 42, Mass.

Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process-control, machine-control, heat-treating, plant-protection, and a host of others. Consult with RCA tube-application engineers for information or advice on possible applications of your own. For examples of electronics at work in our own factories, send for the free 32-page booklet, "Electrons In Action At RCA." Write to RCA, Commercial Engineering Section, Dept. 62-52W, Harrison, N. J.

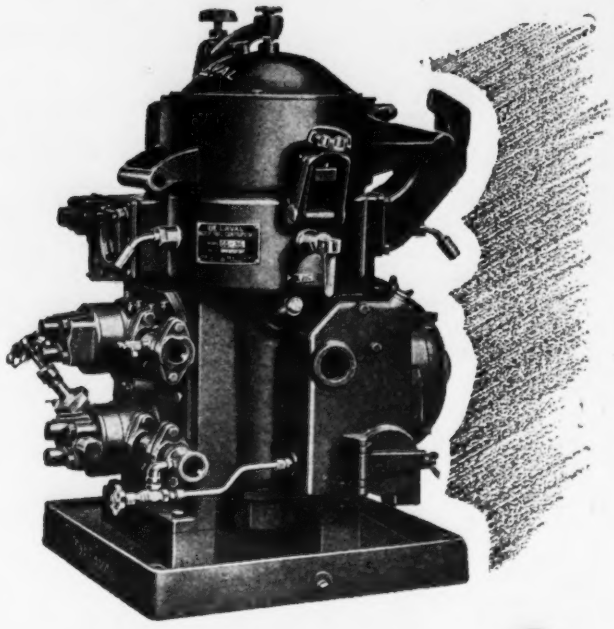
THE FOUNTAIN-HEAD OF MODERN TUBE DEVELOPMENT IS RCA

BUY BONDS RCA BUY BONDS

62-6336-52

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.



How much DOES A DE LAVAL PURIFIER COST?

THE cost of a De Laval centrifugal Oil Purifier of any given size is invariably only a fraction of the cost of the prime mover it protects. The comparatively modest investment represented by a De Laval Oil Purifier is far outweighed by the cost of even one serious shutdown . . . a De Laval is, in truth, inexpensive insurance.

A De Laval Purifier instantaneously removes from lubricating oil all water, dirt or sludge by means of centrifugal force, keeping the oil clean and making it safe to use over and over again. Many generating stations now use the complete De Laval-Funk Process, which minimizes the formation of sludge within the lubricating system while it also continuously purifies the oil by means of the De Laval centrifugal machine—the ultimate in turbine oil protection.

Whether a particular installation calls for a single De Laval Oil Purifier or a complete De Laval-Funk Process, there is a wide range of capacities available, enabling every operator to secure the correct unit for his purpose.

• Write for complete information.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

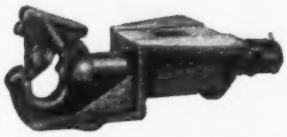
DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

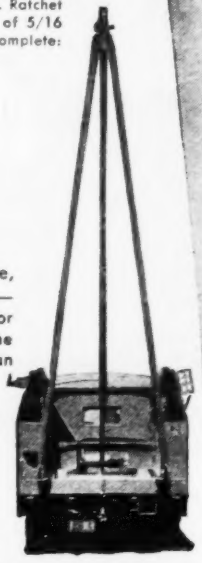
FWD LINE CONSTRUCTION AND MAINTENANCE EQUIPMENT THAT CONSERVES CRITICAL TIME AND MAN-POWER

Model 1775 Pole Trailer Especially adapted for high-speed hauling of poles over short and long distances. Because of its wide tread, this unit trails at high speeds without snaking or whipping. Light in weight, two men can easily lift it onto a truck when moving from one operation to another.

Sure Binder (Handiest tool you ever used) The Sure Binder is a portable hand winch for binding bulky loads of all types. Ratchet type drum holds 18 ft. of 5/16 inch cable. Weight complete: 18½ pounds.



ty Pintle Hooks Provide a sure, connection between truck and trailer — make of truck. Available in sizes for loads of 1 ton or less and up to the al type for towing anything that can ed.

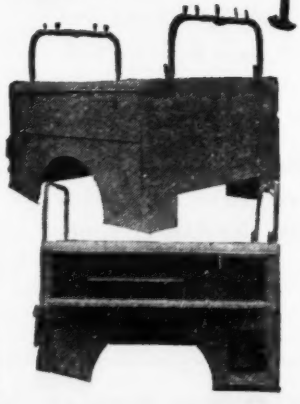


Type Pole Derrick Made of t seamless steel tubing properly ated. Available in sizes to handle om 25 ft. to 70 ft. in length.

OTHER UTILITY TOOLS

- Earth Boring Machines
- Tower Take-Offs
- Duct Rodding Machines
- Low Bed Trailers
- Trailer Hitches
- Cable Laying Plows
- Steel Utility Bodies For Pick-Up Trucks
- Guy Wire Forming and Cutting Tools

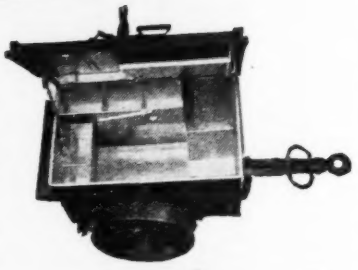
SEND FOR LITERATURE



First Choice OF MORE THAN 150 UTILITIES

FWD offers a complete line of engineered trucks for Utility service. Special power take-offs for operating a winch and boring machine are incorporated into its original design. FWD builds its own cabs and Utility bodies—can furnish conventional or over-engine cabs with seating capacity from 2 to 6 men . . . Write for FWD catalog. "PUBLIC UTILITY TRUCKS THAT FOLLOW THE JOB."

Cable Splicer's Cart—Model S All steel construction — compact — rugged — theft-proof. Compartments for every tool. Folding support leg. Capacity 1000 lbs. Available with either solid or pneumatic tires.



Combination Cable Reel and Pole Trailer This unit has electric steel spoke wheels of integral hub type. Timken roller bearings, and special heat treated chrome vanadium steel springs. All castings are electric steel cast. Axle material is 40-50 carbon steel, specially heat treated. The main frame and cross member 4", 9½ lb. I-beam. All trailers furnished with one set of pole hauling bolsters, and one set of cable reel saddles.

Combination Cargo and Pole Trailer
P8T Series. Available in heavy load capacities of 3100 to 8200 lbs. Extension tongue permits hauling of poles up to 40 ft. Optional electric brakes, side boards, stanchions, etc.

B-6 All Purpose Body
A light weight compact all steel body designed for installation on any half ton chassis. Complete unit weight does not exceed 600 lbs. Storage compartments contain over 54,000 cubic inches. Full height clothing and material compartment. Corrugated steel floor, reduced weight increased strength. Full standardization of design permits easy replacement of damaged body parts or complete sub-assemblies. Tail gate can be secured at 45 degree position, level with floor or fully dropped. Rear ladder bracket removable. Telescoping door stops and solid wood insert converts upper rite door to full length work table and vise holder.

Graybar — Everything Electrical . . . . THAT IT TAKES TO WIN!

E UTILITY SUPPLY DIVISION of the FOUR WHEEL DRIVE AUTO CO., CLINTONVILLE WISCONSIN

LIKE SNUFFING OUT A CANDLE

● Just a hint of a blaze in electrical equipment... and a Kidde built-in system goes into action *fast*. A blanket of carbon dioxide covers it like a candle-snuffer...out goes the fire before it can spread!

Fast fire-killing is just *part* of the Kidde method. The "after it's out" advantages are just as outstanding. The dry, inert gas leaves no mess to be cleaned up—cannot soak apparatus or rot insulation. Damage is confined to the point of rupture—out-of-service time is cut down to a minimum.

Remember, too, that Kidde equipment is approved by the underwriters for protection against Class B flammable liquid fires as well as against Class C electrical blazes. It's the safe, sure way to protect oil reclamation or flammable liquid storage rooms.

Be sure you have full protection against both these types of hard-to-fight fires. Ask a Kidde representative for advice on the best way to safeguard each of the danger spots in the accompanying list.

Kidde Kills Tough Fires

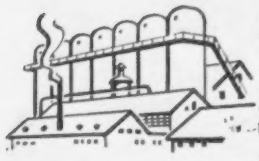
- GENERATORS
- MOTORS
- CONDENSERS
- CONVERTERS
- TRANSFORMERS
- SWITCHGEAR
- LIGHTNING ARRESTERS
- RECTIFIERS
- REGULATORS
- FLAMMABLE LIQUID STORAGE
- FILTER RECIRCULATION

K Kidde

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc. • 140 Cedar Street, New York 6, N. Y.

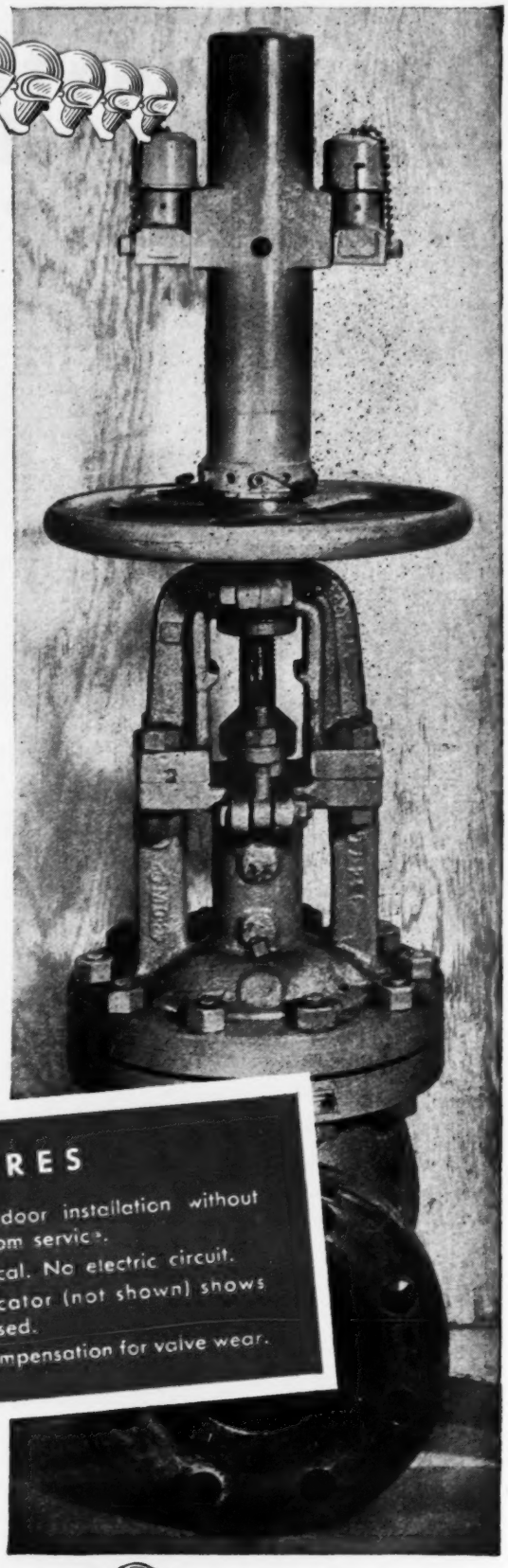
MECHANICAL GUARDIANS FOR CHEMICAL PIPE-LINES



In chemical industries, synthetic rubber plants, oil refineries... any plant, piping precious or potentially hazardous fluids... a mistake, whether unintentional or deliberate, in adjusting a chemical pipe-line valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS... the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached... and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear —one of a number of interlocks specially designed for valve protection.

As safety men of the Bendix "Invisible Crew," BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipe-lines. Write for full information.



CHECK THESE FEATURES

- Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.
- Absolute control of valve opening and closing under all conditions.
- Positions valve in relation to other valves.
- Ample strength characteristics.
- Indoor or outdoor installation without removing valve from service.
- Fully mechanical. No electric circuit.
- Position indicator (not shown) shows valve open or closed.
- Adjustable compensation for valve wear.

*TRADE MARK OF BENDIX AVIATION CORPORATION

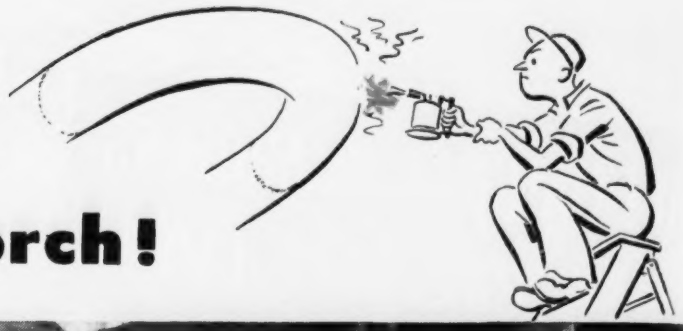
Products of this division are members of "The Invisible Crew"—precision equipment which 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

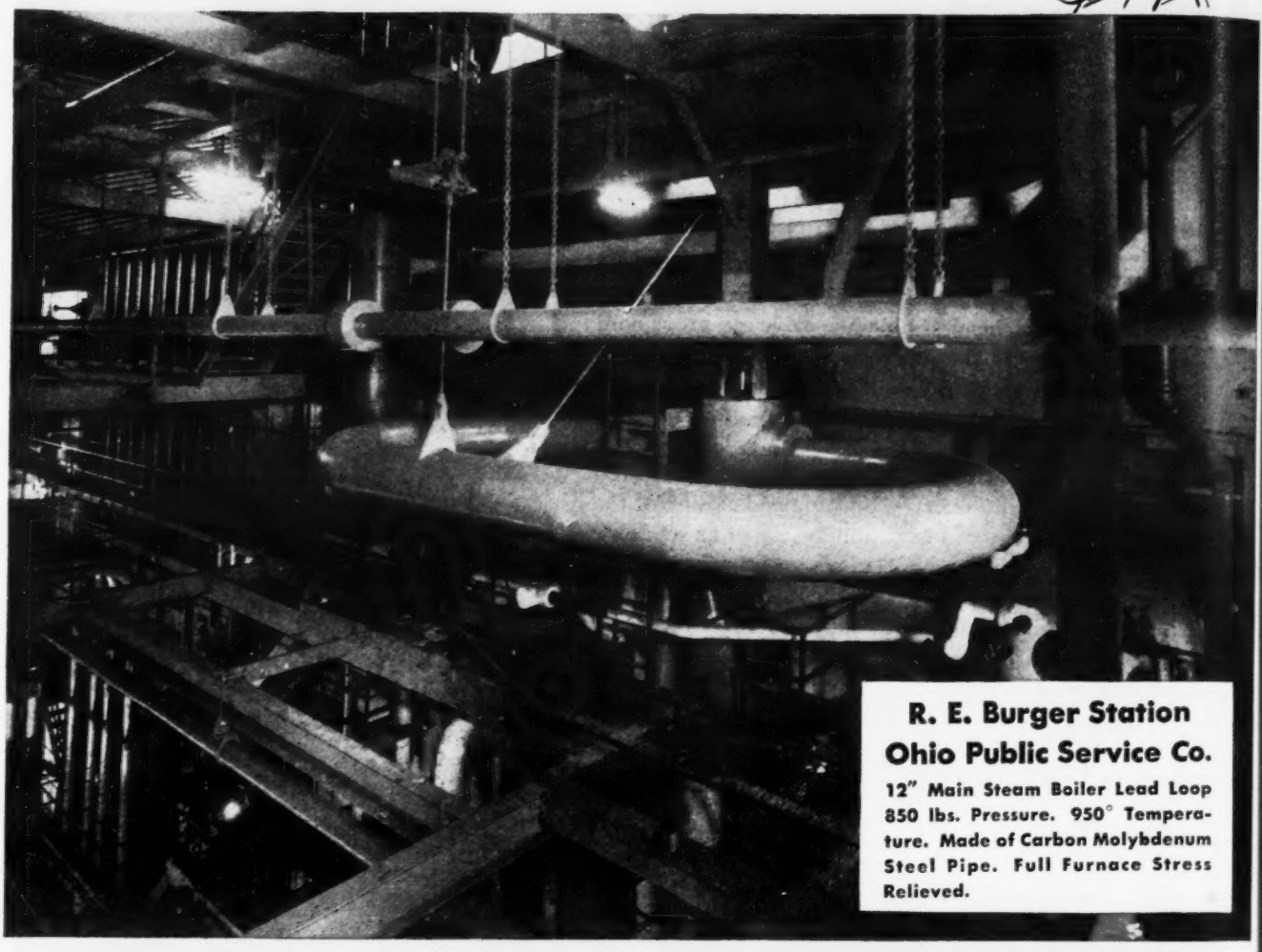
THE INVISIBLE CREW

Precision Equipment by Bendix Aviation Corporation

BENDIX MARINE DIVISION • One Hanson Place, Brooklyn, New York

You wouldn't tackle this job with a Blow Torch!





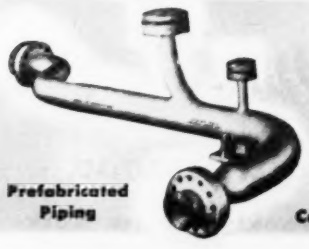
R. E. Burger Station
Ohio Public Service Co.
12" Main Steam Boiler Lead Loop 850 lbs. Pressure. 950° Temperature. Made of Carbon Molybdenum Steel Pipe. Full Furnace Stress Relieved.

Trying to stress-relieve this main steam boiler lead loop with a blow torch in the field would be ridiculous.

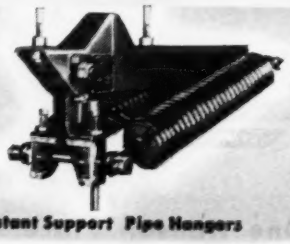
Grinnell provides the specialized shop equipment to handle this class of work. Grinnell engineers and technicians have resourceful "know-how" gained from long experience. By continuous laboratory research and experimentation they are developing new processes and techniques for the prefabrication of piping for higher pressures, higher temperatures and corrosive services.

Contact Grinnell whenever piping plans call for *interpretive engineering, laboratory research* and *shop fabrication.*

GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.
Pipe Fabrication Plants:
Providence, R. I.; Atlanta, Ga.; Warren, Ohio



Prefabricated Piping



Constant Support Pipe Hangers

GRINNELL

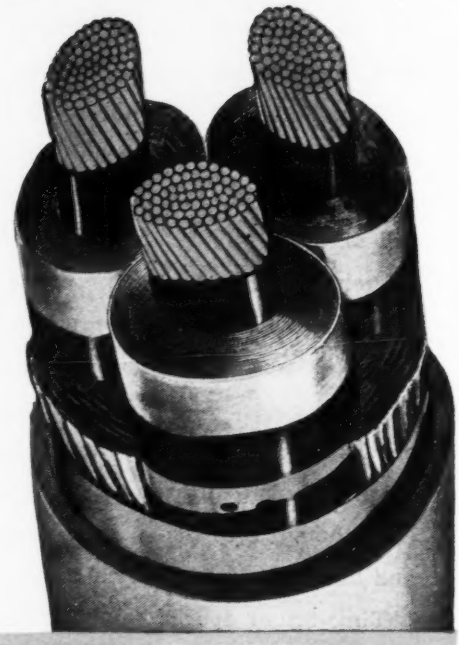
WHENEVER PIPING IS INVOLVED

5 years ago

ANACONDA INTRODUCED THIS REVOLUTIONARY ADVANCE IN POWER CABLE CONSTRUCTION...

Since then successful electrical operation proves the advantage of Anaconda Type CB (Carbon Black) Power Cable and establishes the importance of

Oxidation Control



THE PURIFYING EFFECT of a special highly-adsorbent carbon-black in Type CB Cable actually stabilizes the oil to prevent breakdown due to heat and electrical stress. Oxidation is effectively blocked. In the Type CB construction the configurations of stranded conductors are also smoothed, thus reducing maximum stress.

In cyclic aging tests by a utility laboratory, Type CB Cable maintained a low, uniform power factor at temperatures up to 117° C. and at double operating voltage.

Type CB Cable is another example of Anaconda's many "firsts" in quality, performance—and economy too. Obviously Type CB gives you a lot more for your cable dollar. Ask to see graphic demonstrations of its all-round advantages.

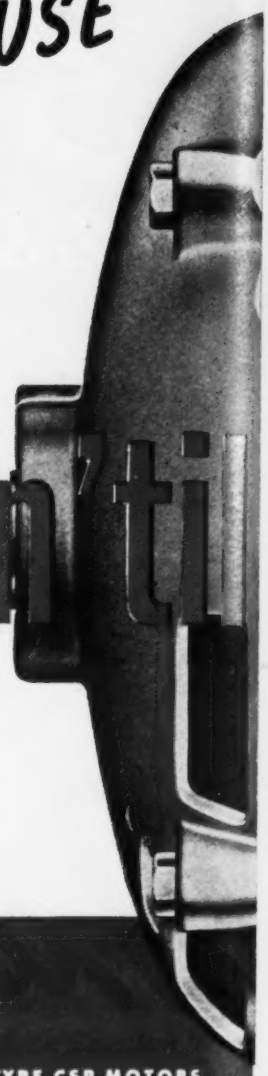
ANACONDA

Anaconda Wire & Cable Co.

GENERAL OFFICES: 25 Broadway, New York City 4 — *Subsidiary of Anaconda Copper Mining Company*

CHICAGO OFFICE: 20 North Wacker Drive 6 • Sales Offices in Principal Cities

ANOTHER WESTINGHOUSE MOTOR "FIRST"



"No Lubrication" ti

PRELUBRICATED BALL BEARINGS PRACTICALLY ELIMINATE BEARING MAINTENANCE...NOW STANDARD ON TYPE CSP MOTORS UP TO 3 HP

Twenty-two years ago Westinghouse was "first" with the "Sealed-Sleeve" Bearing that eliminated oil leakage, kept out dirt, and reduced maintenance on sleeve bearing motors. Today Westinghouse offers the first self-sealed, prelubricated ball bearing that eliminates lubrication for five years. Type CSP prelubricated motors bought now will need no lubrication until 1950.

Prelubricated bearings in Westinghouse motors have been thoroughly field-tested in thousands of Westinghouse lint-free textile motors. Recently a series of bearings was chosen at random and inspected from a group of 600 motors, the first of which were installed between six and seven years ago. All were in perfect condition—even though they had been in operation 24 hours a day and had never been lubricated.

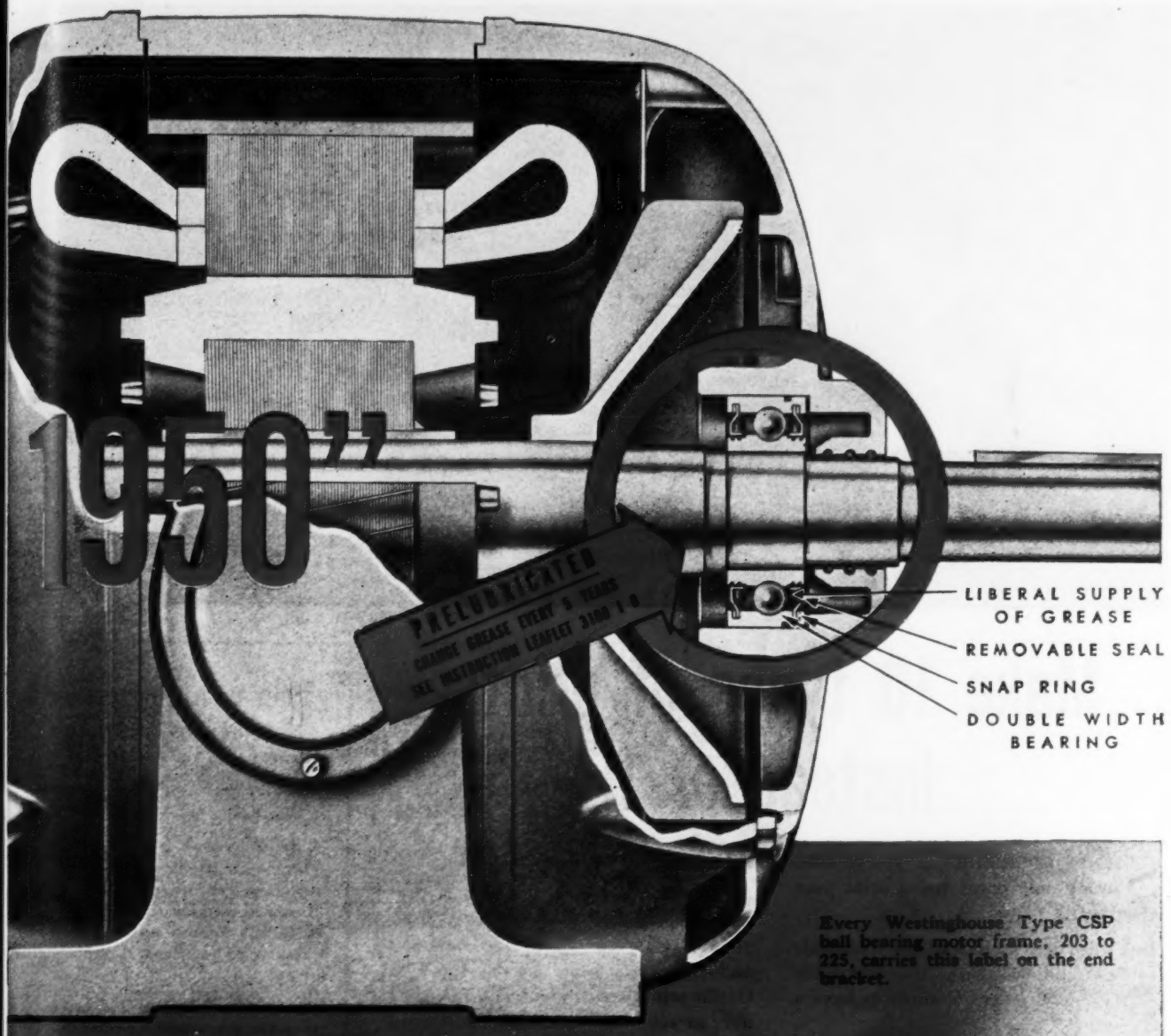
Time-tested special applications such as these have often paved the way for improvements in standard motors. Type CSP motors incorporate the fruits of wide Westinghouse motor application experience. When you buy a Westinghouse Type CSP motor, you get all the latest improvements. For complete information, write for DB 3100-CSP, Westinghouse Electric & Mfg. Co., P.O. Box 868, Pittsburgh 30, Pennsylvania. J-21318

ADVANTAGES

OF WESTINGHOUSE TYPE CSP MOTORS

- PRELUBRICATED SEALED BALL BEARINGS reduce lubrication maintenance ... assure longer grease life.
- IMPROVED TUFFERNELL INSULATION.
- DYNAMICALLY-BALANCED ROTOR.
- DIE-CAST ROTOR with oversize fan.
- LIBERAL THROUGH-VENTILATION—air enters front, leaves at drive-end of motor.

WESTINGHOUSE

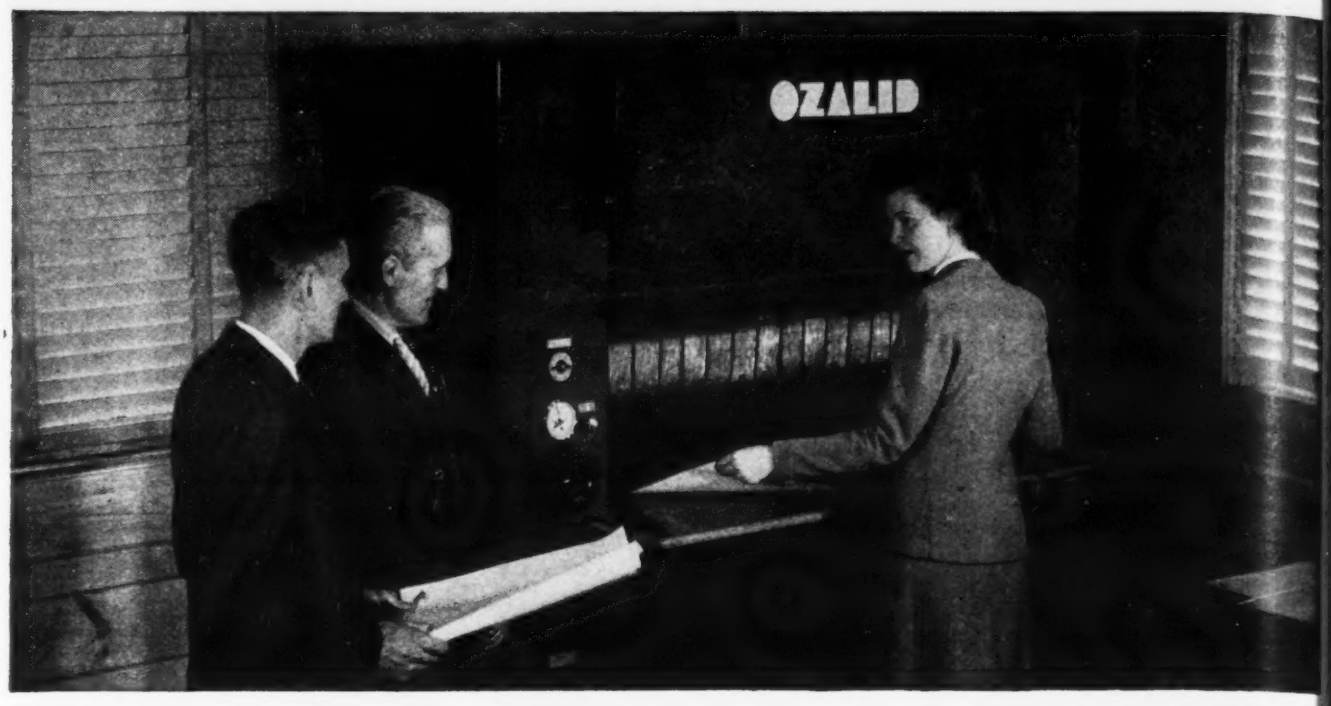


Every Westinghouse Type CSP ball bearing motor frame, 203 to 225, carries this label on the end bracket.

PRELUBRICATED SEALED BEARING CONSTRUCTION ... retains original grease packing within the stationary seal discs. Bearing chamber accommodates grease sufficient for more than five years of severe service. Held by snap rings, seal discs fit closely over inner race, forming an efficient seal. Snap rings and discs are easily removed to permit packing new grease in bearings.

Westinghouse

TYPE CSP MOTORS



Make 10 types of prints instead of 1

SOUNDS INCREDIBLE if you've been seeing only one type of print year after year.

But when you are one of the thousands using Ozalid, you know this is possible . . . and how much it means to have a choice.

You always order the Ozalid print fitted for the job . . . and get it without delay.

You are constantly finding new uses for OZALID – for one type of print or another. Not in the drafting room alone, but in all departments. For example, with Dryphoto, photographic subjects can be reproduced for use in the shop, or for sales, advertising or general display purposes.

You actually pay less for this versatility: time, labor and materials are saved on every side.

Why you get 10 instead of 1

An Ozalid machine is different. It produces a positive reproduction direct from your original in only two steps—*Exposure* and *Dry-development*. *All* ten types of Ozalid prints are produced in this manner, in seconds – without additional equipment.

Since no baths or driers are employed – there is no distortion, there are few "limitations." So far, OZALID RESEARCH has created ten different and practical types of sensitized materials utilizing the unique dry-developing principle.

There will be more!

OZALID RESEARCH continues . . . and the machine you invest in today will provide even greater versatility tomorrow.

Write for free booklet of Ozalid prints and catalogue telling whole story.

ARMY (E) NAVY

OZALID

DIVISION OF GENERAL ANILINE AND FILM CORPORATION • JOHNSON CITY, N. Y.
OZALID IN CANADA—HUGHES-OWENS CO., LTD., MONTREAL

Only OZALID gives you ten types of prints

1. Black-line

2. Blue-line

3. Red-line
For shop and office reproductions of drawings, typed material, forms, etc. Assign identifying colors to prints of different departments; distinguish checked from unchecked prints, etc.

4. Opaque Cloth
For exceptionally durable prints for shop use, permanent file copies, etc.

5. Transblack Intermediate

6. Sepia-line Intermediate

7. Transparent Cloth
For producing "duplicate originals" which may be substituted for originals in subsequent print production; lines may be removed with OZALID corrector fluid—invaluable time saved when making design changes.

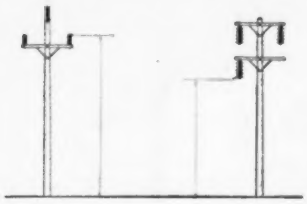
8. Transparent Foil
For making composite prints; reclaiming old, or worn originals; for producing extra-fast duplicate originals.

9. Chartfilm
For producing lustrous black-line prints on durable white plastic base. Oil proof, waterproof. Ideal for use as instrument panels, identification cards, etc. No protective covering needed; clean with damp rag.

10. Dryphoto
For almost instantaneous, high-quality reproductions of any photographic subject: in black, sepia, or two-tone effect.

LINE POST CONSTRUCTION IS ECONOMICAL

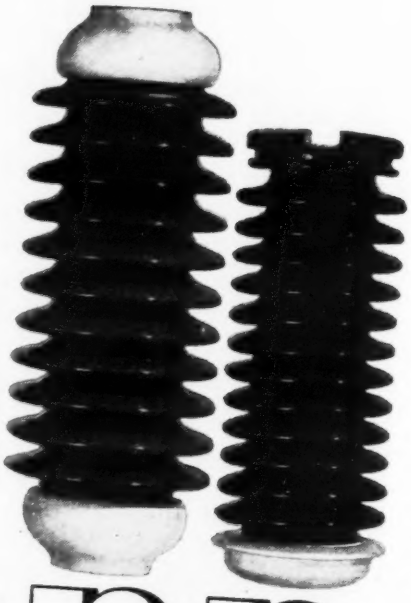
FOR CONVERSION TO HIGHER VOLTAGES *OR* NEW BUILDING



Any still-sound transmission line can be converted to higher voltage at low expense—and economically of manpower—by reinsulation on Line Posts. Ordinarily only new cross-arms and insulators are needed, and the job can be done with hot-line tools or during low-demand hours. For new construction, Line Posts offer substantial advantages in cost and operating performances. Because of the Line Post's upright height, it provides extra ground clearance —or in some cases the opportunity to use poles of the next shorter length.

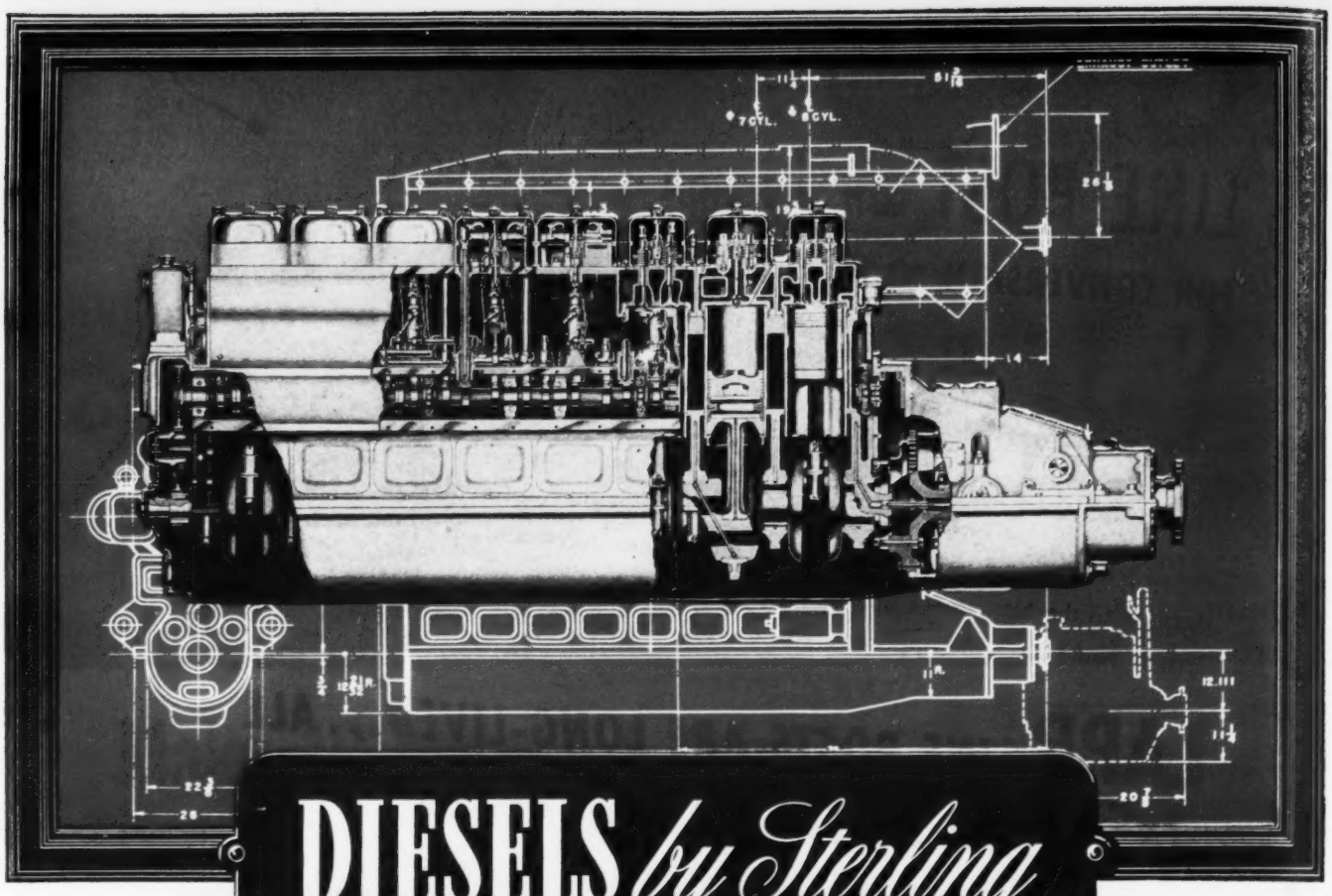
LAPP *LINE POSTS ARE LONG-LIVED... ALL HARDWARE EXTERNALLY ATTACHED*

A feature of the Line Post in the original Lapp design was the *external attachment of all hardware,* and the elimination of nested porcelain parts. An inherent characteristic of porcelain is that it is at least ten times as strong in compression as in tension. Much of the failure from cracking in conventional insulators comes from bursting tension forces induced by thermal change. Lapp considers that its original conception was sound, and offers Line Post and Station Post insulators with all hardware externally attached—and still claims "*no cracking*" as a feature of these units.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.



DIESELS *by Sterling*

Out of 40 years of fine engine building

PRODUCTION of the new Sterling Viking Diesel engine is so geared now that almost immediate deliveries are available. Write us for full details of this new power plant for marine or industrial use which gives you the compactness of a gasoline engine of the same power rating plus the economy of diesel fuel. Other Sterling engines—six or eight cylinders—gasoline or gas from 85 hp. to 1800 hp.

ORDERS ACCEPTED NOW FOR EARLY DELIVERIES

"KEEP BUYING WAR BONDS"

STERLING

VIKING DIESEL

STERLING ENGINE COMPANY 1292 Niagara St., Buffalo 13, N. Y.

New York City, 900 Chrysler Bldg. • Washington, D. C., 906 Evans Bldg. • Chicago, Illinois, 855 Board of Trade Bldg.

In shipyards portable electric cables and cords must be tough

TIREX SELENIUM Rubber Armor
Unequalled for Long Life Toughness and Resistance to Abrasion

Simplex-TIREX - 3 Conductor Cable
Type W

Type W - without ground wires.
Type G - with ground wires,
Type SH-A-without ground wires, shielding over each conductor.
Type SH-C - without ground wires, shielding over cabled conductors.
Type SH-C - with ground wires, shielding over cabled conductors.
Type SH-D - with ground wires, shielding over each conductor.

Simplex-TIREX, the original rubber-sheathed cable, was specially designed for hard service with portable electric equipment. It is extensively used in shipyards, mines, quarries, industrial plants and wherever flexible cables carry current to portable electric equipment. There is a size and type to meet every requirement and performance records accumulated during the past twenty-five years prove that no better cable can be had for such service.

The smaller cords are suitable for drills, riveters and other tools; larger cables are specially designed for welders, shovels and the heavier machines; all have flexible conductors, high grade insulation and the selenium rubber armor that has become a distinguishing feature of Simplex-TIREX because of its toughness and resistance to abrasion.

Your flexible electric cables or cords should always be selected to fit the machine or tool that will depend upon them for current. The type of work to be performed and any unusual exposure to wear and tear should be kept in mind. Conductors of proper size with adequate insulation and protection from mechanical injury are essential. When you are selecting cords or cables to meet your operating conditions our experience can be of value to you.

Buna S has replaced natural rubber in Simplex rubber insulations and jackets.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

ARMY E NAVY M

Simplex
WIRES and CABLES

Dependable EXIDES serve the Central Station's battery needs

In electric light and power stations, in every state, trustworthy Exides are on full time duty. They stand ready to respond promptly and powerfully whenever called upon for closing and tripping switch gear, for continuous control bus operation, for emergency lighting, or other storage battery needs.

Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industrial plants is proof of their dependability, long-life and ease of maintenance. When you buy an Exide, you *Buy* to *Last*.

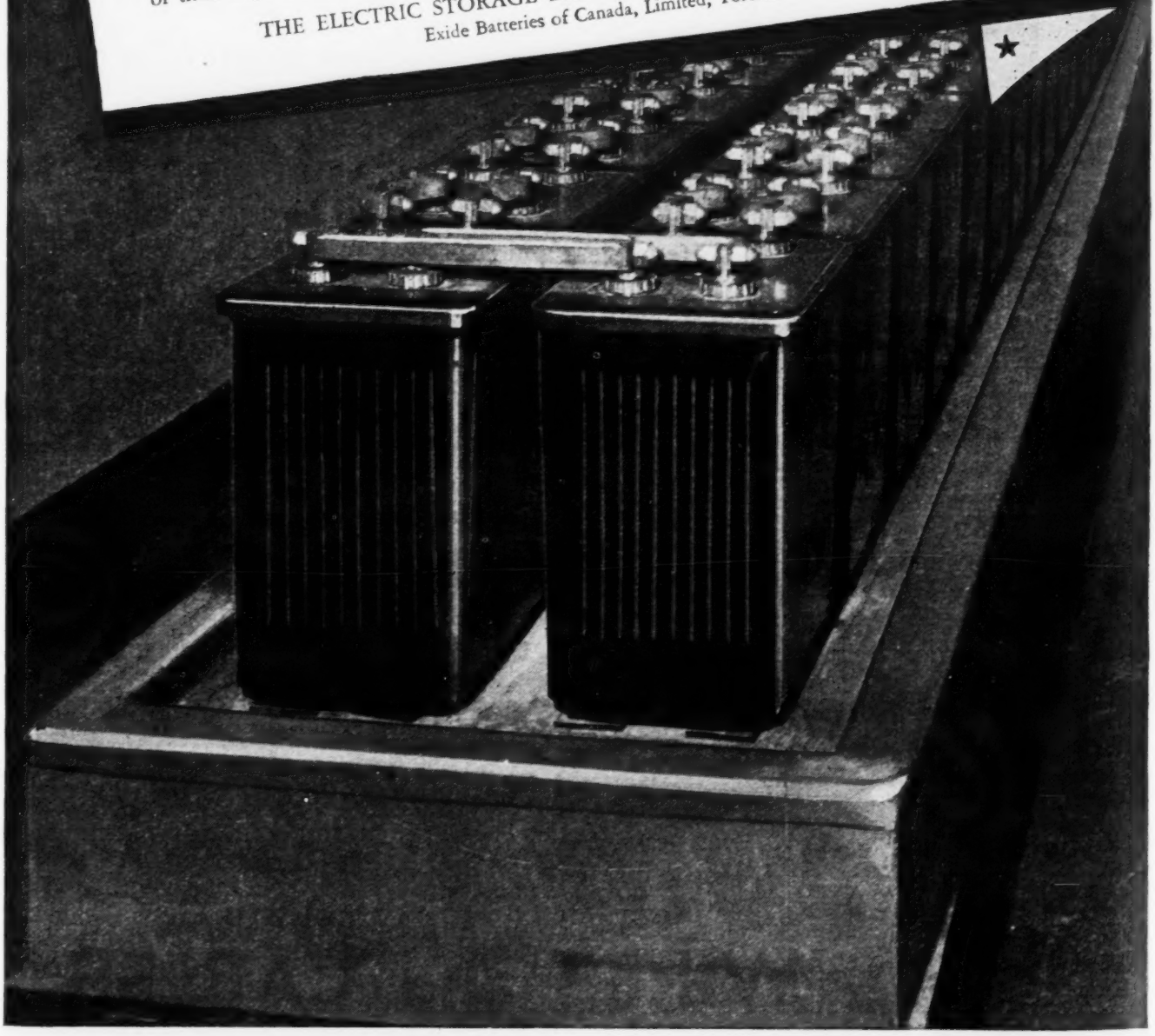
Whatever your battery problems, Exide engineers will be glad to help you solve them.

ARMY E NAVY

Exide BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto



BRADEN Truck Winches will perform efficiently, safely and economically on any job. One user says, ". . . Frankly, we bought our first Braden Winch because we were unable to buy the make we had been using. But now, because of Braden's superior performance, we'll never buy any winch except a Braden."*

The above unsolicited testimonial, proving the superiority of BRADEN performance on the job, is only one of many received every year.

There is a BRADEN Truck Winch for every handling job, and one to fit any truck. There are models rated from 6000 lbs. to 100,000 lbs. capacity . . . all engineered to give long service with minimum maintenance. The BRADEN Winch pictured above, is model M6-15B, with rated capacity of 12,000 lbs. on first layer. This is another *new* winch in the BRADEN line, and is already a recognized leader of its class, in the power winch field.

See your BRADEN Dealer for information concerning the entire line of BRADEN Truck Winches, or write direct to the factory for catalog, which will be ready soon.

From actual letter on file in our office.

"Buy BRADEN — They are SAFER"

RADEN WINCH COMPANY
001 East Admiral Boulevard

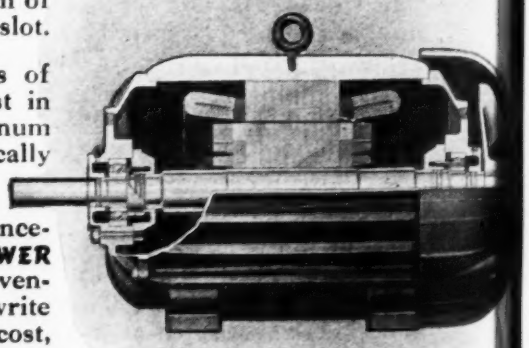
BRADEN
Winches

TULSA 3,
Oklahoma

...and after installation, you can forget a SEALEDPOWER MOTOR

The Crocker-Wheeler **SEALED-POWER** Motor makes the maintenance man's job easy. Here's why:

1. The totally-enclosed frame seals out harmful foreign matter. There is no danger of oil, corrosive liquids, acid or alkali fumes, air-borne moisture, steam, conducting dusts or metal chips, for example, causing premature breakdown of windings.
2. There are no ventilating passages in the frame to require periodic cleaning. Cooling air is blown over the outside surfaces of the motors, not through the frame.
3. Patented *Grooveseal* bearings require re-greasing only once a year or even less frequently. Seal permits use of softer grease, for better lubrication and longer bearing life. Retains grease.
4. Vacuum impregnation of windings reduces hotspot temperature and lengthens insulation life. Prevents vibration of wires inside or outside of slot.
5. Bars, fans and end rings of *Alucast* rotor are die cast in one operation from aluminum alloys, forming a practically indestructible rotor.



And yet, with all these maintenance-cutting advantages, **SEALEDPOWER** Motors cost no more than conventional fan-cooled types. Why not write for descriptive literature? No cost, no obligation.

CROCKER-WHEELER

A Division of JOSHUA HENDY IRON WORKS

AMPERE, NEW JERSEY

Branch Offices: BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · DETROIT · LOS ANGELES · NEW YORK · PHILADELPHIA · PITTSBURGH · SAN FRANCISCO · WASHING

SQUIRREL CAGE MOTORS · WOUND ROTOR MOTORS · DIRECT CURRENT MOTORS · GENERATORS · FLEXIBLE COUPLINGS

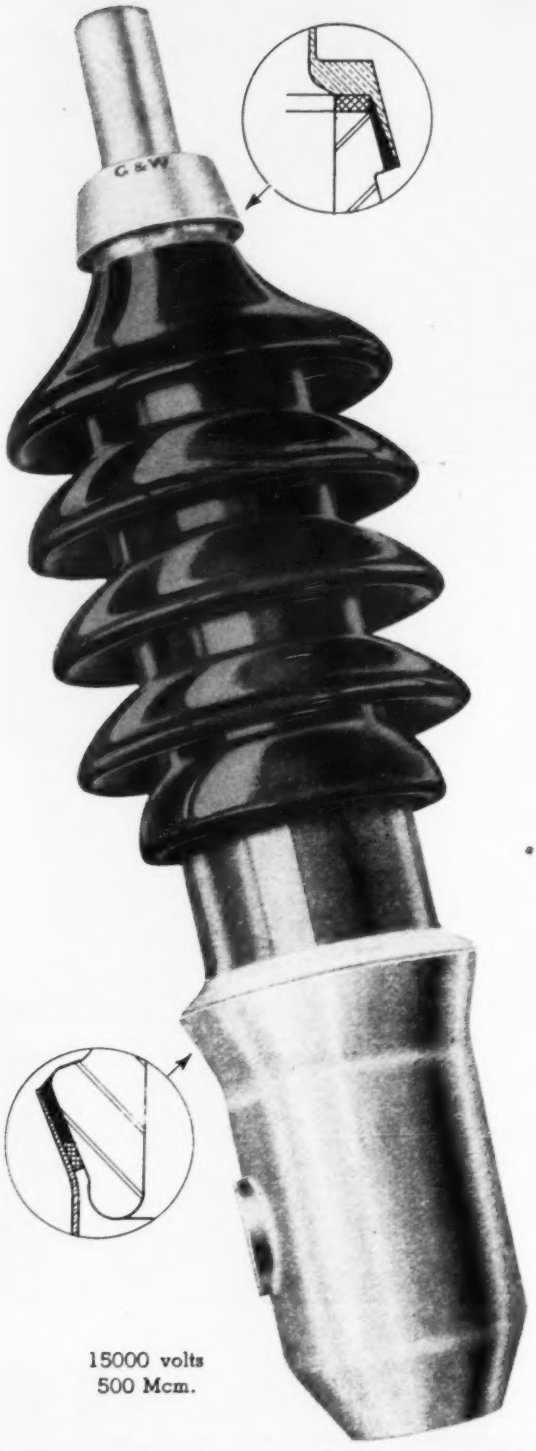
Soldered porcelain potheads

G&W TYPE "ST"

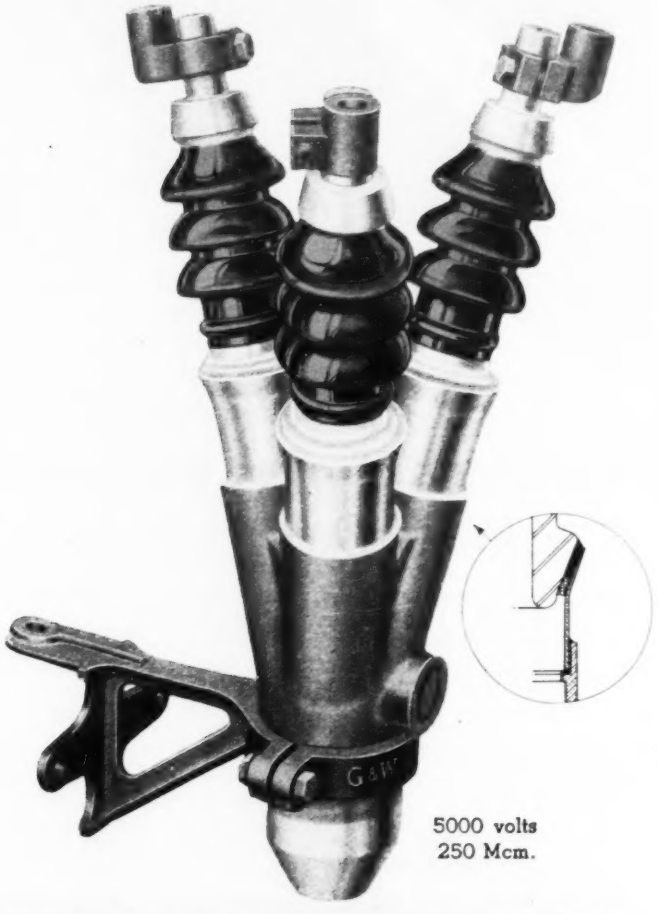
SUCCESSFULLY DEVELOPED

JOINTS PERMANENTLY SEALED; OIL, AIR and MOISTURE TIGHT-WITHOUT GASKETS

Type "ST" potheads are available only in limited quantities owing to the wartime restrictions in the use of 50-50 solder, which gives best results. The G & W process of soldering metal to porcelain has proved satisfactory in several years actual service on highly important installations. A complete line of soldered porcelain potheads will be available after the war . . . We shall welcome the opportunity now to design the particular forms which will best meet your requirements.



15000 volts
500 Mcm.

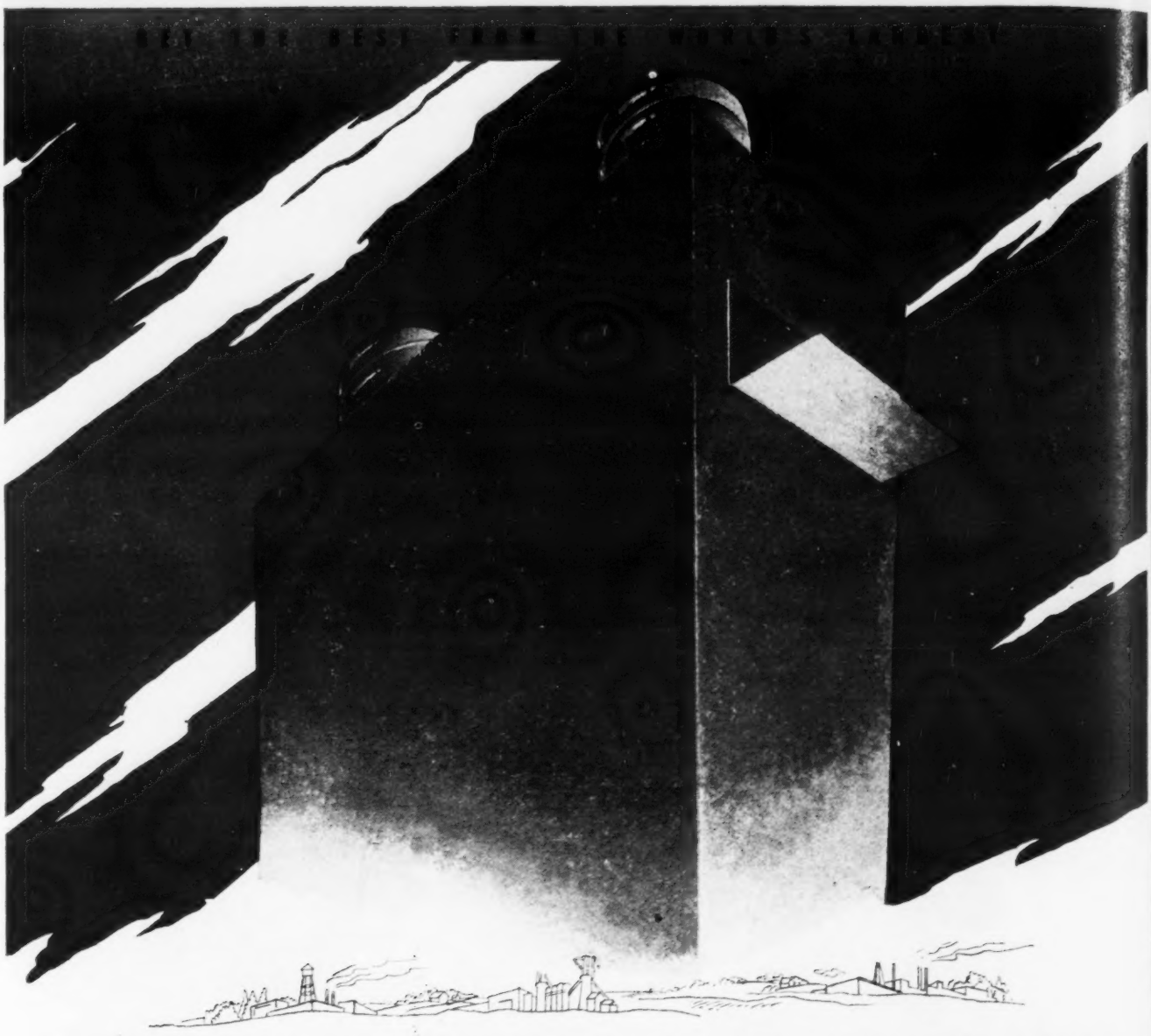


5000 volts
250 Mcm.

Standard Ratings: 5000-7500-15000-23000-34500-46000 VOLTS; Up to 2500 Mcm.

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.
Representatives in Principal Cities

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES . . . MULTITAPS . . . SPLICING KITS



SATISFYING KILOVAR REQUIREMENTS OF LARGE LOCALIZED LOADS

with C-D capacitors in banks

In C-D Capacitor banks, many utilities have found the best answer to present demands for large blocks of reactive. Flexible, efficient and quickly installed, these C-D Capacitor banks will supply the required Kva with minimum delay and use of critical materials. Our engineers will be glad to discuss the advantages of C-D capacitor banks as applied to your specific problems. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

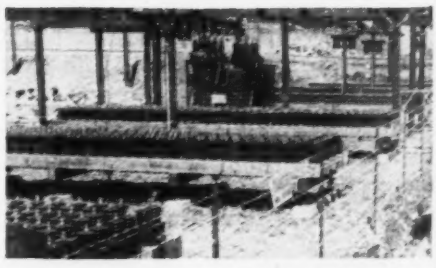
ADVANTAGES OF C-D CAPACITORS

EXTREME FLEXIBILITY — Circuit arrangement permits the switching of corrective capacity to conform to load.

EXTREME MOBILITY — C-D Capacitors can be quickly removed to other locations to relieve sudden low power factor.

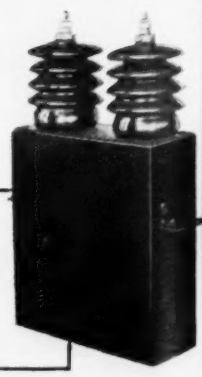
QUICKLY INSTALLED—Can be installed and put into operation in a fraction of the time required for other types of corrective equipment. Use less critical materials.

MAXIMUM EFFECTIVENESS — Capacitors are the most efficient reactive source and require a minimum of maintenance and attention.



A C-D CAPACITOR BANK INSTALLATION

Part of a large bank of 15KVA, 7960 volt Individual Outdoor Capacitors installed on 13,800 volt system at a Light Metals Plant.



15 KVA 7960 Volt
1 phase 60 Cycle
Individual Outdoor Capacitor

CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

FOR LIGHT TRANSMISSION LINES

Specify

Drop Forged Clamps

Designed for dead-ending the lighter duty transmission and distribution lines — hundreds of thousands of these familiar and accepted snubbing type clamps are in use in all parts of this and other countries — and for good reasons . . .

- Forged steel gives a light-weight clamp of adequate strength.
- A short connection length protects the conductor against vibration effect.
- Ample radius of snub, smooth cable seat and long clamping keeper prevent damage to the conductor.
- Side opening type is easy to install and work with hot line tools.
- Reversible two-groove keepers accommodates a wide range of conductor sizes.
- For full detail, write — Engr. Dept. C.F. Div.

Through [illegible] Manufacturer Only

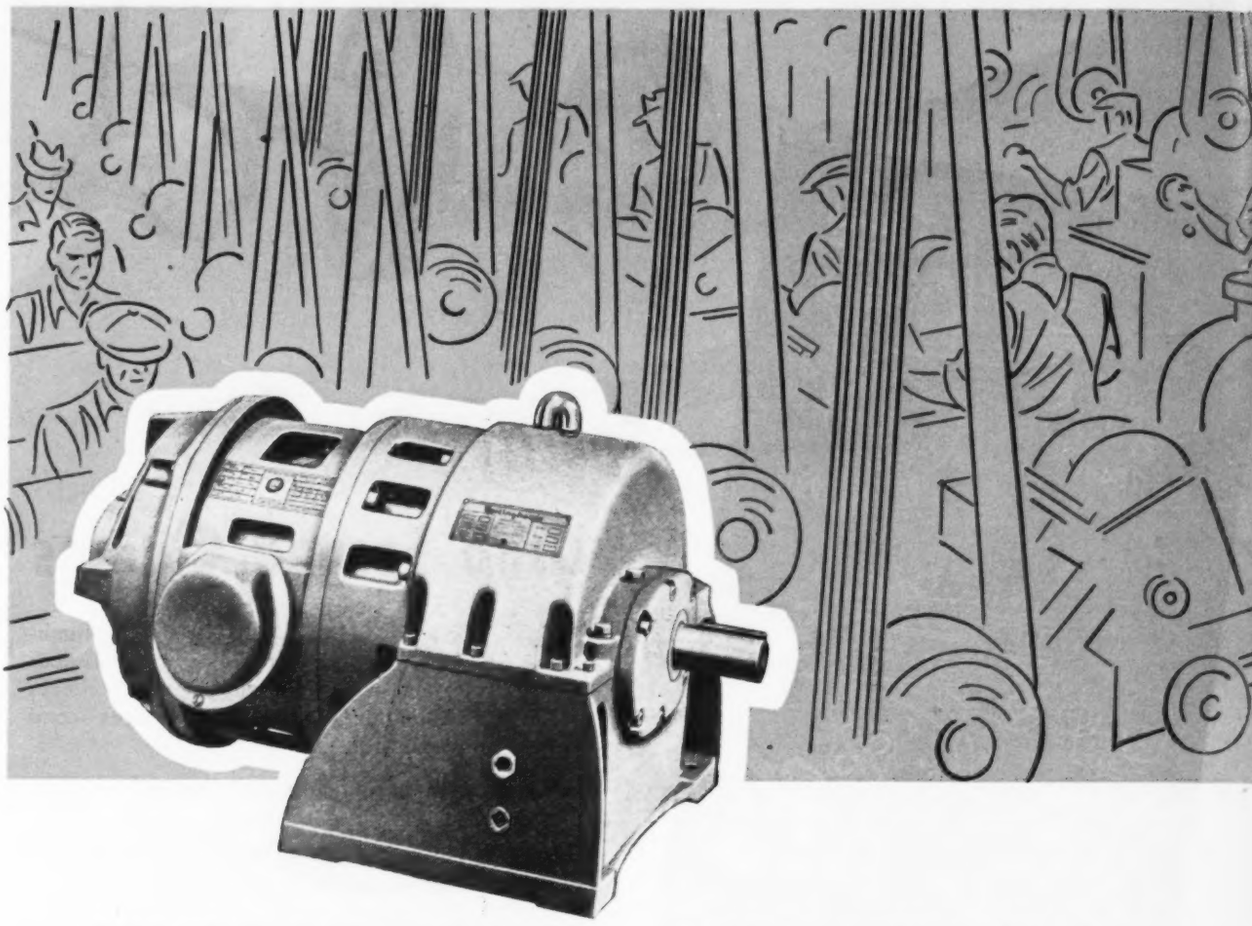
B-T-C

Drop Forged Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

When you modernize...

USE A GEARMOTOR



W.P.B. indicates that we'll all be pushing war production for many months. And then the heat goes on reconversion.

Much of your equipment, running at peak load since 1941, probably needs to be replaced or modernized. Whichever you need . . . replacement or modernization . . . use a gearmotor when the drive requires speed reduction. Here's why.

A gearmotor is the most efficient means of speed reduction available today. It's more compact . . . lasts longer with less maintenance . . . is easier to install . . . lower in over-all cost . . . and safer for your employees. These advantages are not idle claims . . . for they've been proved in actual industrial installations.

Westinghouse offers a complete line of gearmotors for any speed reduction application from 1 to 75 hp. Each unit is specifically designed to conform to industry-wide A.G.M.A. standards. Each new unit contains many improved exclusive design features. Call your nearest Westinghouse office for details. Westinghouse Electric & Manufacturing Company, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-07227

Westinghouse Gearmotors

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Four out of five drives need speed reduction

Electrical TERMINALS

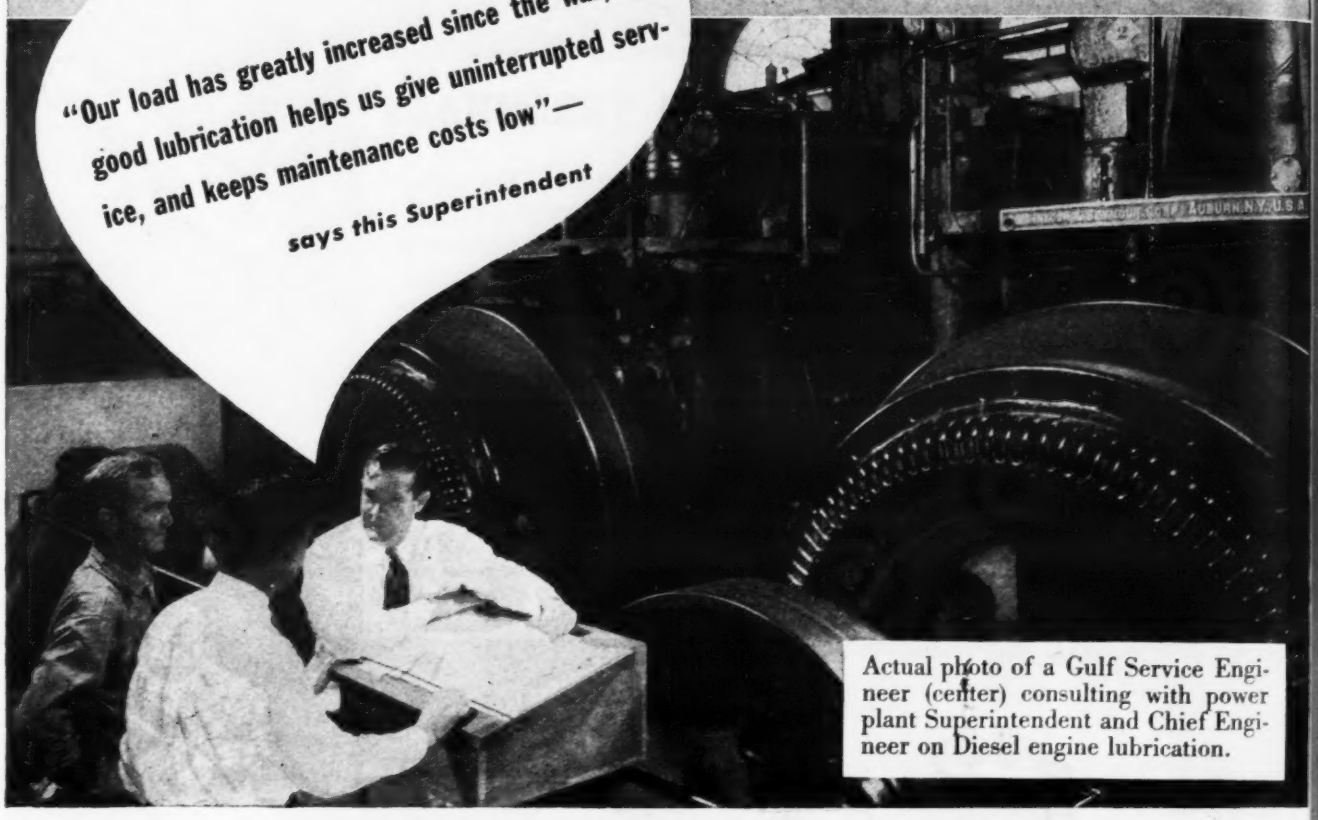
Terminal problems are many and varied. But whether simple or complex, any connector problem is best terminated here at connector headquarters. Catalog describing the complete Burndy line available on request. Engineering cooperation freely offered. Burndy Engineering Co., Inc., 107J Bruckner Blvd., New York 54, N. Y.

Headquarters for CONNECTORS

Burndy

In Canada: Canadian Line Materials, Limited, Toronto 13.
Foreign: Philips Export Corporation, 100 E. 42nd Street, New York 17, N.Y.

No repairs for 16 years with GULF PARVIS OIL !


"Our load has greatly increased since the war, but good lubrication helps us give uninterrupted service, and keeps maintenance costs low"—
says this Superintendent

Actual photo of a Gulf Service Engineer (center) consulting with power plant Superintendent and Chief Engineer on Diesel engine lubrication.

NO REPAIRS NECESSARY for over 16 years, and operating efficiently today under a greatly increased load—that's the hard-to-beat performance record of our two 600 h.p. Diesels with Gulf Parvis Oil," says this Superintendent. "Proper lubrication pays us big dividends—uninterrupted service and negligible maintenance costs."

Additional proof that Gulf Parvis Oil provides better lubrication for large stationary and marine Diesels! And better lubrication means lower maintenance costs, improved performance.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate — call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements.

Gulf Parvis Oil is available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION · GULF REFINING COMPANY

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
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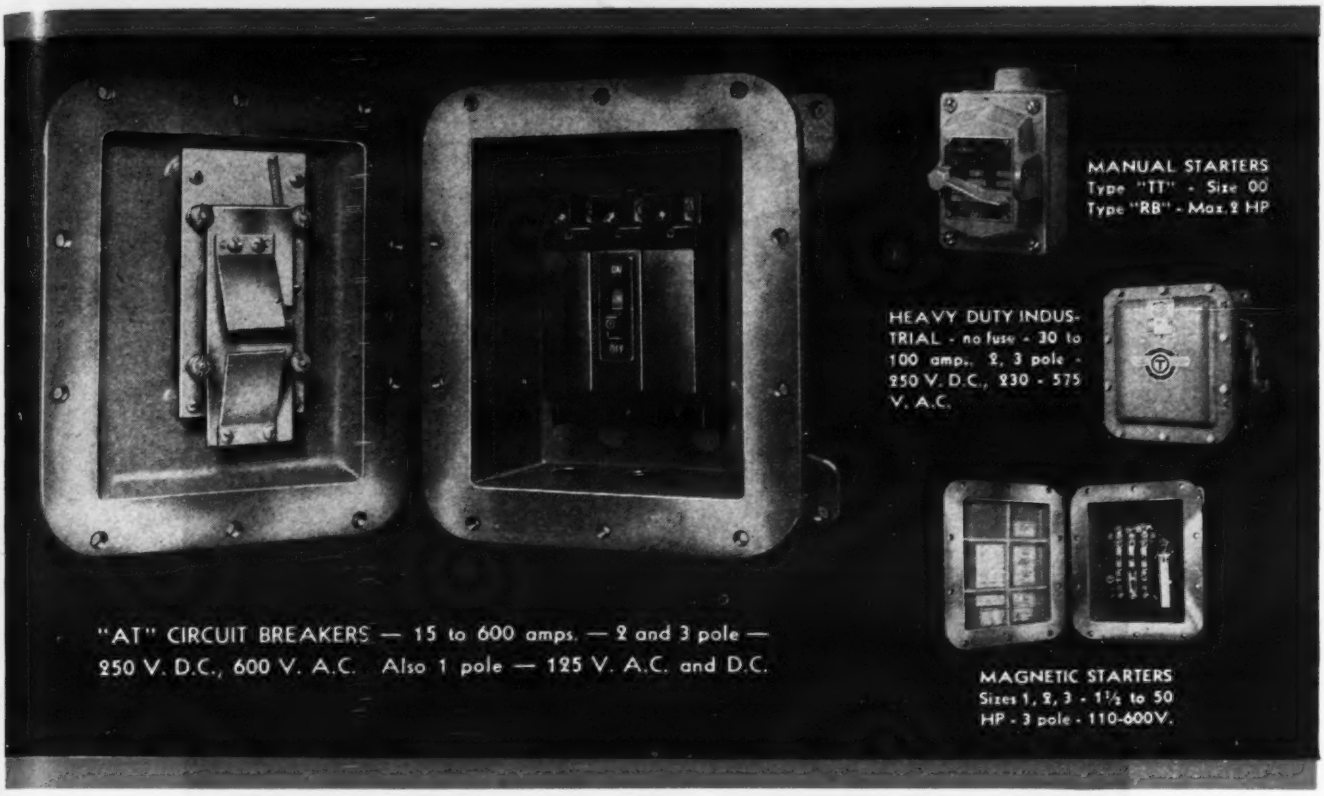
TRUMBULL

EXPLOSION-PROOF EQUIPMENT


MANUAL STARTERS
Type "TT" - Size 00
Type "RB" - Max. 2 HP
HEAVY DUTY INDUSTRIAL - no fuse - 30 to 100 amps., 2, 3 pole - 250 V. D.C., 230 - 575 V. A.C.
"AT" CIRCUIT BREAKERS — 15 to 600 amps. — 2 and 3 pole — 250 V. D.C., 600 V. A.C. Also 1 pole — 125 V. A.C. and D.C.
MAGNETIC STARTERS
Sizes 1, 2, 3 - 1½ to 50 HP - 3 pole - 110-600V.

- Enclosures are precision made of heavy cast semi-steel . . . designed to assure adequate protection and built to withstand all conditions of heavy duty explosion proof service.
- Covers are bolted to box with metal-to-metal; accurately machined matching surfaces assure a tight contact.
- Circuit breakers have front operation. Switches can be locked "on" or "off".
- Enclosures are designed to allow comfortable space all around enclosed mechanisms for wiring inspection or removal.
- Heavy corner mounting lugs immediately accessible, facilitate installation and grouping of units.
- All enclosures are attractively finished in machine grey. They add to the appearance of your installations.

THE features incorporated in Trumbull Explosion Proof Enclosures (NEMA Type 7, NE Code Class 1, Group D. Also Class II, III and IV) assure maximum safety where it is necessary to install Circuit Breakers, Magnetic Starters or Switches in atmospheres containing gasoline, petroleum, naphtha, alcohol, acetone, lacquer solvent vapors, and other volatile liquids.

In design and construction special emphasis has been given to LONG TERM safety . . . extra strength, simple design, elimination of possible human error in installation, inspection or maintenance. Write for Trumbullaid Circular No. 315.

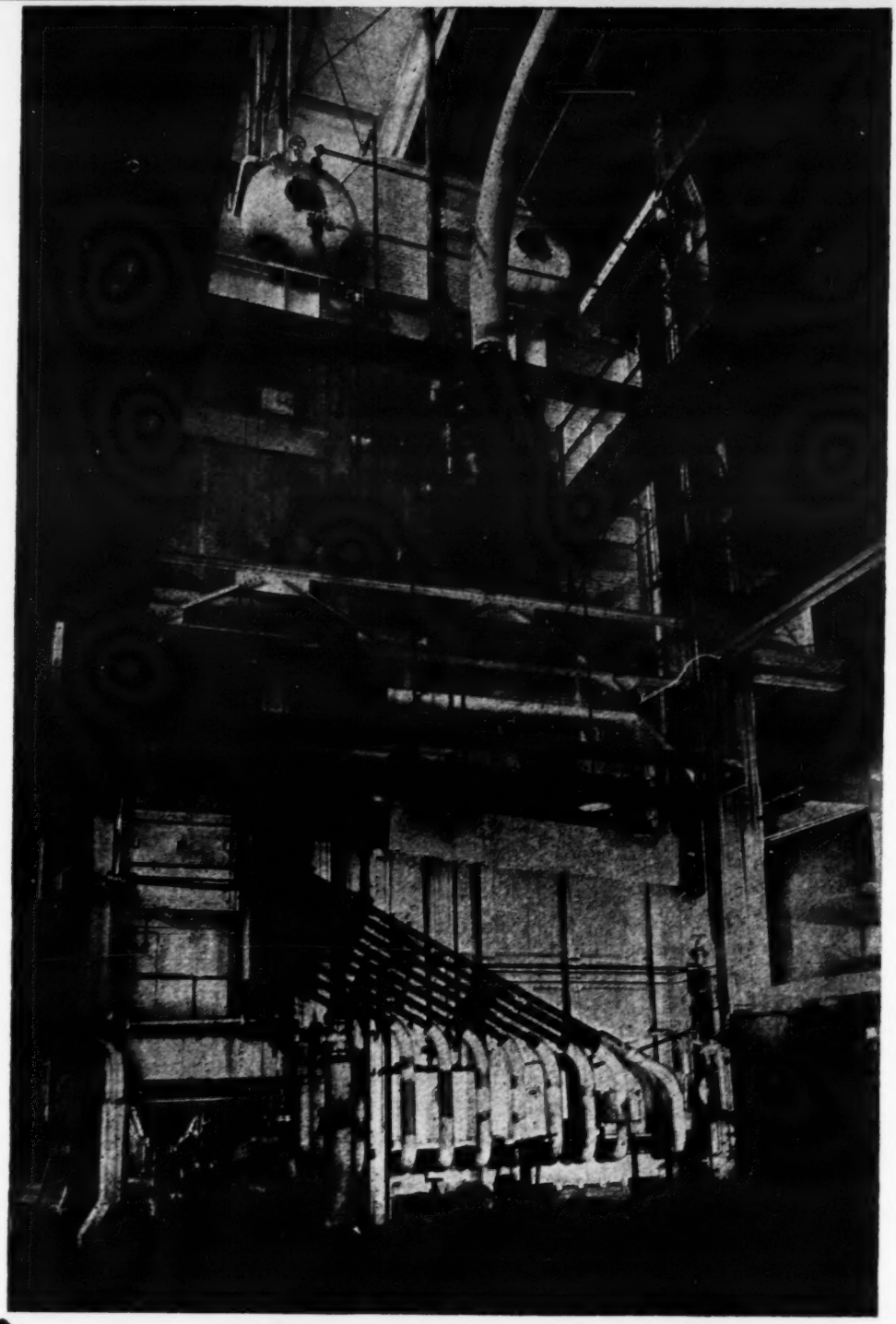
THE TRUMBULL ELECTRIC MANUFACTURING CO.

A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O.
SEATTLE — SAN FRANCISCO — LOS ANGELES

PLAINVILLE, CONNECTICUT

1940
1944
Duplicate



FW FOSTER

Steam Generator

ORIGINAL UNIT EXCEEDED GUARANTEED EFFICIENCY AND MAINTAINED GUARANTEED CAPACITIES

Four years ago a large industrial plant installed a Foster Wheeler Bent Tube Steam Generator. Plant expansion recently necessitated additional steam capacity and a duplicate boiler was ordered. Determining factors which influenced this selection were the consistently low maintenance and high average yearly efficiency of the first unit. Efficiency for 1942 was 82.8%*, and for 1943, 82.6%* when burning midwest coals at a continuous load of 175,000 lb. of steam per hour, at 225 psi, 515 deg. F. final steam temperature and 215 deg. F. feed water to unit.

These Steam Generators are of the three drum, bent tube design and include completely water-cooled furnaces, superheaters, economizers and are fired with spreader type stokers.

*Design efficiency 83%. Corresponding test efficiencies approximate 84.5%.

FOSTER WHEELER CORPORATION
165 Broadway New York 6, New York

WHEELER

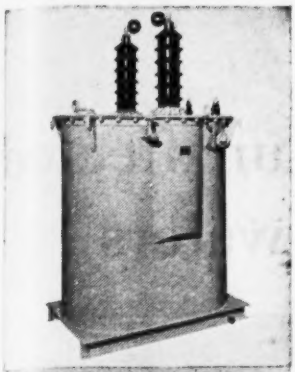
In Mobile Radio Western Electric FM equipment leads the way!

TODAY wherever our Armored Forces fight, Western Electric FM tank radio helps to guide and speed the attack. Designed by Bell Telephone Laboratories, this equipment operates on 80 crystal-controlled channels, any 10 selected instantly by push buttons. It's built to withstand unholy pounding—and to transmit battle talk clearly through "boiler factory" din. This tank radio job has brought us added knowledge and new techniques that will benefit all users of mobile radio tomorrow.

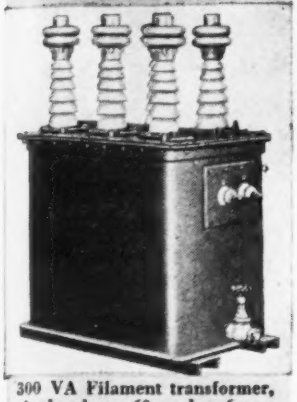
TOMORROW mobile radio will branch out as never before—serving light and power companies, fire and police departments, trucking operators, bus lines and others who need instant communications to help them operate efficiently. New FM equipment designed by Bell Telephone Laboratories—world's largest organization devoted to research and development in all phases of electrical communication—will be made by Western Electric as soon as final Victory permits.

Western Electric — Distributed by Graybar

Buy all the War Bonds you can—keep all the War Bonds you buy!

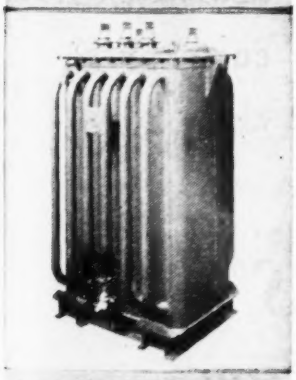


Single phase, half wave rectifier plate transformer, 60 cycles, 220 volts primary, 110,000 volts secondary.



300 VA Filament transformer, single phase, 60 cycles, 6 secondary windings of 5 volts each; 3 secondary windings operating 40 KV above ground and 3 secondaries operating 20 KV above ground.

60 KVA, three phase, 60 cycles, 211 volts. Delta primary, 3900 / 6755 / 7800 / 13510 volts Wye secondary.



150 KVA Distribution transformer, single phase, 600 high voltage, 240/120 low voltage.

Fire!

REDUCE THE HAZARD WITH AMERTRAN ABESTOL IMMERSED TRANSFORMERS

Fireproof AmerTran Abestol Immersed Transformers reduce both the possibility and the extent of fire damage. That's why they earn lower insurance rates and permit vaultless indoor installation, with its convenience, flexibility and accessibility. To industry, AmerTran Abestol Immersed Transformers offer the advantages of load center installation: copper savings, finer voltage regulation, lower line losses and improved motor performance. If necessary, they may be mounted overhead because the chemically inert Abestol, which requires no maintenance, is sealed. In comparison to transformer oil, Abestol possesses higher insulating properties and similar heat transmission characteristics.

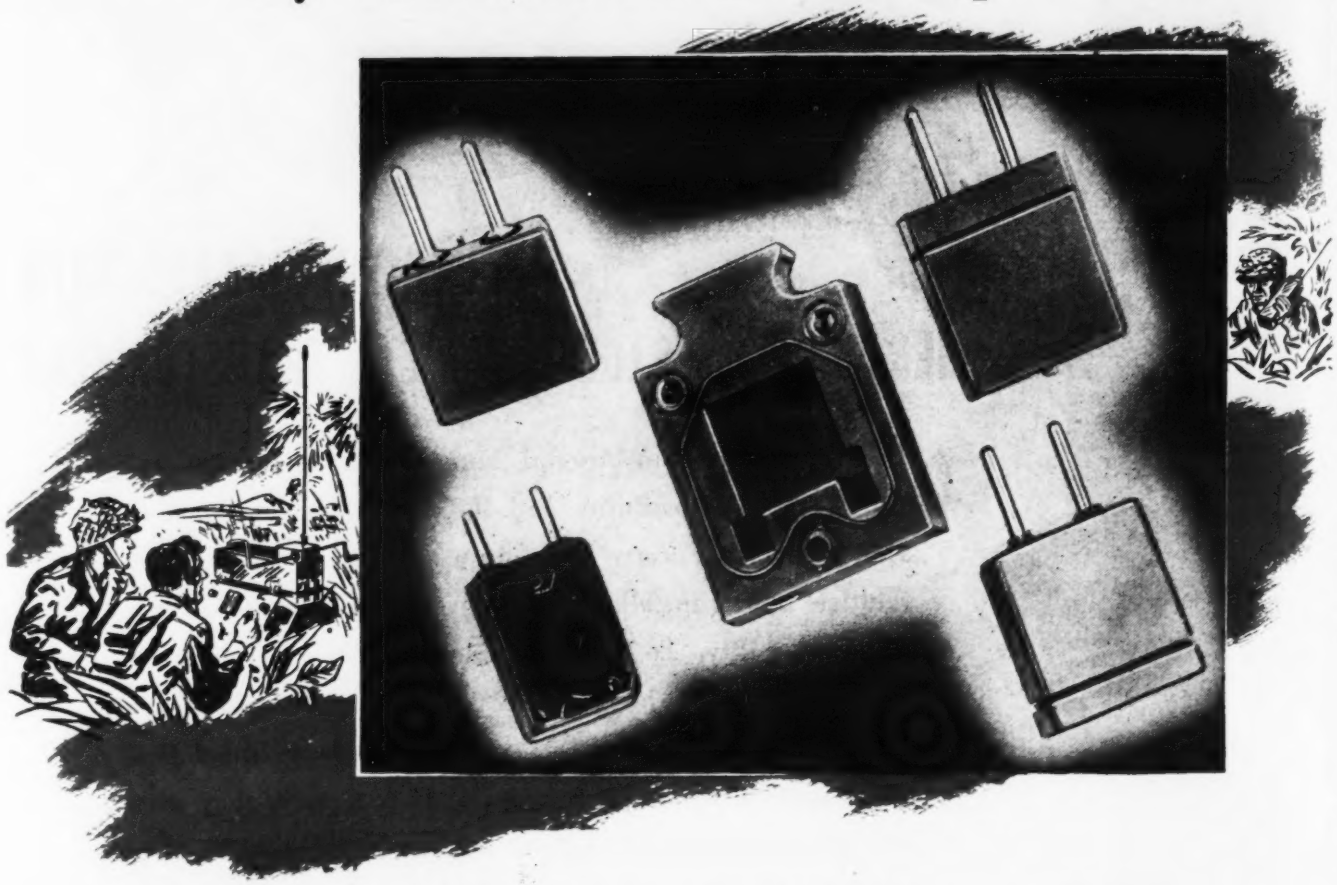
Send for further information.

AMERICAN TRANSFORMER COMPANY
178 EMMET STREET, NEWARK 5, NEW JERSEY

AMERTRAN

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

Melmac Crystal Holders unaffected by submersion in swamp waters



Moisture, dampness, and high humidity of swamps and jungles were a threat to electronic equipment operation...until MELMAC* plastics came to the rescue. Tested by the U. S. Army Signal Corps under the worst conceivable service conditions, MELMAC is now recommended for quartz oscillator plate holders.

Crystals must be protected so that moisture can't reach the crystal surfaces. Also, the frequency of oscillation of crystals must be rigidly controlled and remain unaffected under most severe service conditions. MELMAC's low water absorption (tested by submersion in swamp waters), uniform electrical resistance, and high dimensional stability assure satisfactory performance under all conditions. Here is another instance where Cyanamid's hi-dielectric plastic is doing a vital job at war.

Complete information on MELMAC's adaptability to present and postwar electrical applications will be sent on request. Additional data is available in the handbook, "MELMAC MOLDING COMPOUNDS."

Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY
Plastics Division
30 Rockefeller Plaza · New York 20, N. Y.

Cyanamid Plastics

Beetle · Melmac · Melurac
Laminac · Urac

THE Hidden Strength OF COPPERWELD WIRE

At first glance, Copperweld Wire looks like solid copper

BUT LET'S TAKE A LOOK INSIDE

... Here, hidden from view, but always on the job, is a high strength alloy steel core. This gives Copperweld strengths from 120,000 to 180,000 pounds per square inch, making it the ideal conductor for long spans and for many applications where high strength, conductivity and corrosion resistance are required.

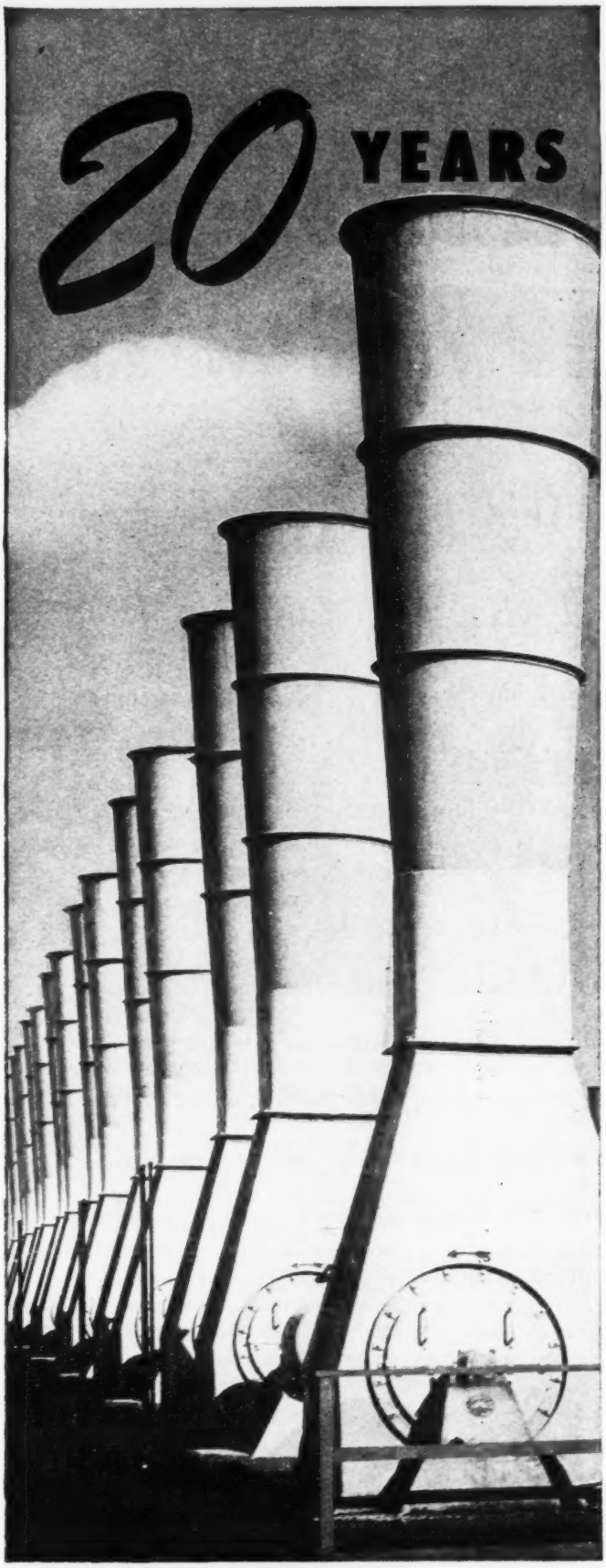
Because Copperweld consists of a thick protective layer of pure copper molten welded to an alloy steel core, this wire has the best electrical conductance of any high strength conductor and greater tensile strength than any wire of comparable electrical properties. So when you need top performance in power conductors, wire, strand and ground rods—specify Copperweld.

Copperweld

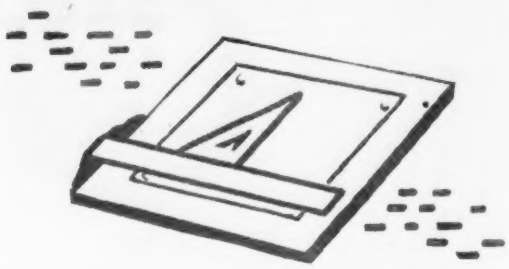
RODS · WIRE · STRAND

ARMY E NAVY

COPPERWELD STEEL COMPANY, GLASSPORT, PA.



OF STACK DESIGN



SINCE 1924 the service given by thousands of "Thermix Fan Stacks" has proved the soundness of their unique basic design.

Advantages of combining the stack, fan and breeching in a single unit make possible an accurate determination of stack efficiency under any given condition.

Draft losses from bends in breeching are eliminated thus minimizing stratification. Gases leaving the fan enter the divergent stack directly where gradual diffusion occurs until the gas is discharged into the atmosphere. "Impact resistance" is thus reduced.

Installation problems are eliminated by the exclusive "Thermix Fan Stack" design which permits direct mounting on the boiler. Breeching to the stack is unnecessary —installation and material costs are reduced proportionately. Write for the bulletin on Thermix Stacks.

•

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

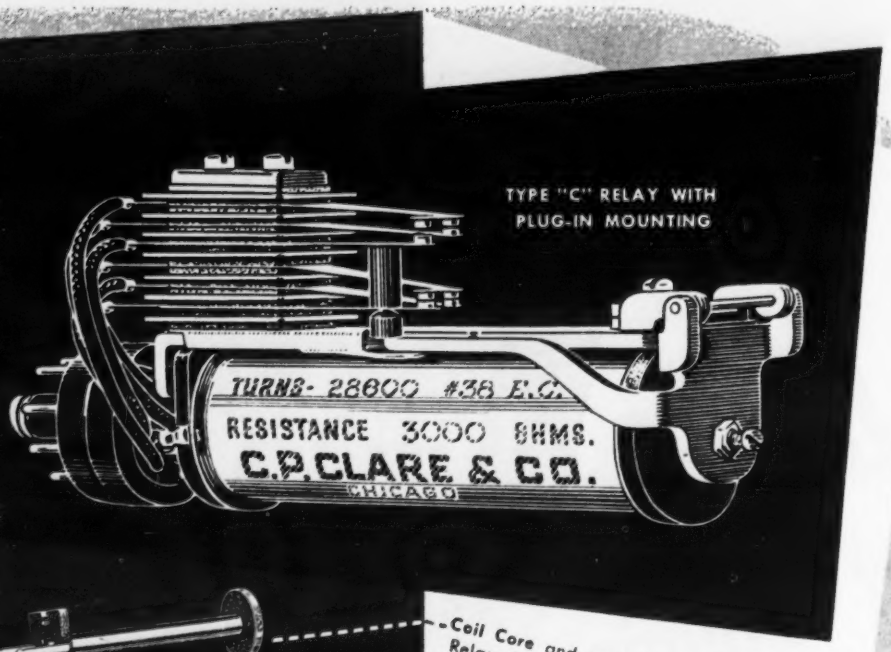
PRAT-DANIEL CORPORATION

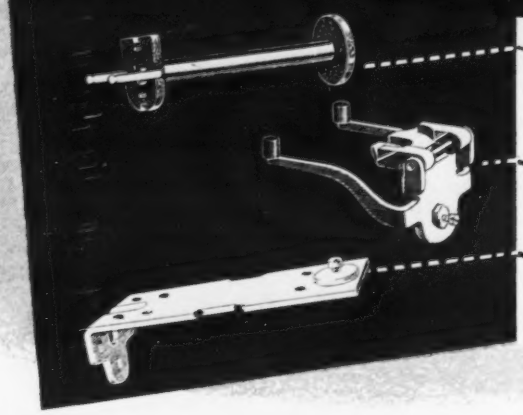
EAST PORT CHESTER, CONN.

CLARE

"Custom-Built"

RELAYS





Coil Core and spool assembly of Type "C" Relay The core, machined within very close tolerances, is of the highest grade magnetic iron. Spool ends are pressed on and securely staked in place.

Armature of Type "C" Relay may be right hand, left hand or double. Residuals may be fixed (welded) or adjustable with lock screw as shown.

Heelpiece of Type "C" Relay, like the other components of magnetic circuit, is of highest grade magnetic iron, carefully annealed after machining.

Provide LOWER OVERALL RELAY COST...

SIMPLIFIED INSTALLATION...

DEPENDABLE PERFORMANCE

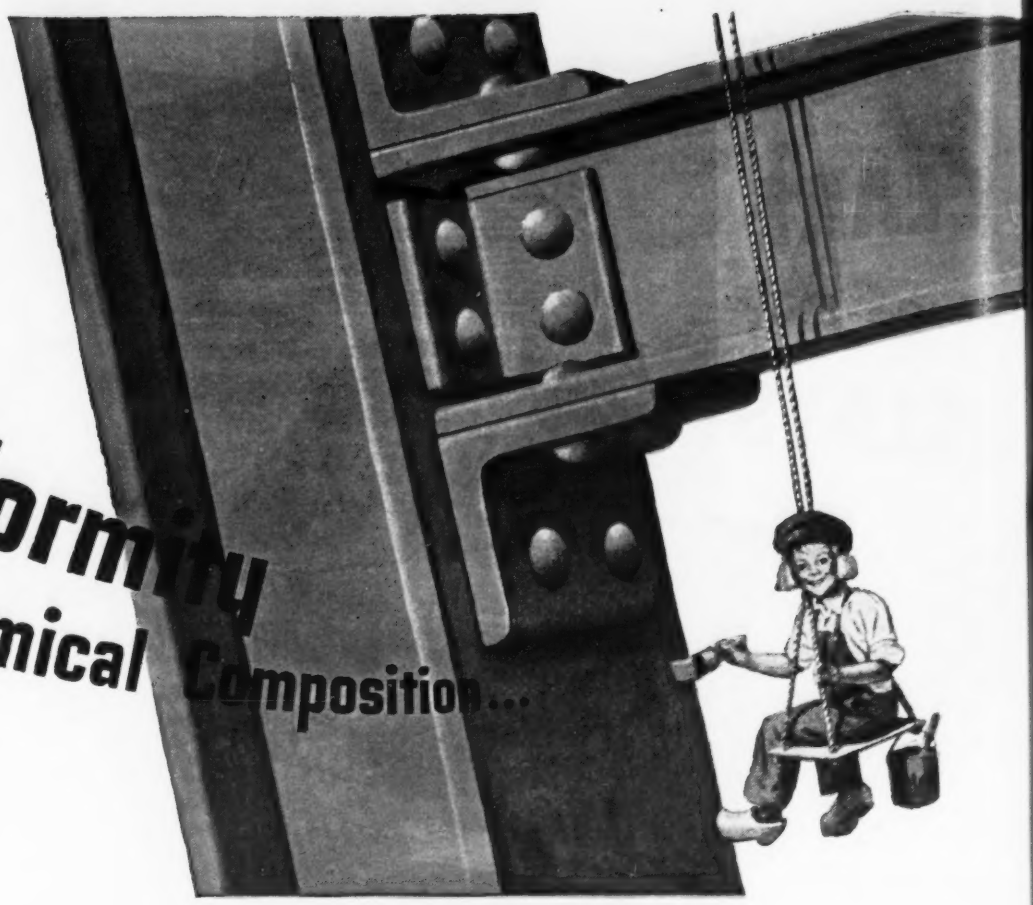
Industrial designers and engineers everywhere have found Clare "Custom-Built" Relays so flexible in construction, operating characteristics and precision adjustment . . . so carefully built from only the finest of materials . . . so rugged and long-lived . . . that they are ideally applicable to the widest range of utility uses.

Clare "custom-building" assures dependable performance on circuits demanding special or unusual functions, and are fully reliable under extreme conditions of temperature, humidity, atmospheric pressure, voltage and vibration. Installation is simple . . . overall, long-run costs are lower in applications such as radio, electric, electronic and "electric eye" controls, alarm systems, counting equipment.

If you have a design problem involving the use of relays, by all means submit it in confidence to our highly skilled engineers. They will gladly work with you in developing or recommending the relay best suited to your needs. Write for Clare catalog and data book today. Address: C. P. Clare & Co., 4719 W. Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use



Uniformity of Chemical Composition...

...another real reason why RED LEAD means Extra Protection against Rust

Red Lead's outstanding uniformity of performance results not only from its extreme purity but also from its precise chemical composition... lead orthoplumbate. This makes for predictable chemical behavior.

For many years Red Lead has been the standard among metal protective paints because of inherent fundamental properties of the pigment itself.

Among the most important of these is Red Lead's definite chemical composition and uniformity—as distinguished from pigments which have indefinite composition or vary from batch to batch, with resulting possibility of variation in performance.

One reason for this uniformity is that Red Lead is a simple chemical compound, being made from oxygen and high purity metallic lead. Consequently, Red Lead is an extremely pure compound. It contains no corrosion accelerating impurities such as water-soluble salts of chlorides or sulfates.

Uniform composition means dependable performance, day after day, job after job.

Furthermore, Red Lead has the property of counteracting acid conditions, recognized as accelerators of rust. In the presence of various acids, Red Lead forms insoluble neutral lead salts at the approximate rate at which the acids are supplied. This is true whether the acids originate from acid forming environments, such as gas, smoke and moisture in the atmosphere, or from the decomposition of the vehicle. Thus, a rust inhibiting condition is maintained with a Red Lead paint.

Remember, too, that Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including phenolic and alkyd resin types.

Specify RED LEAD for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

Write for New Booklet

"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

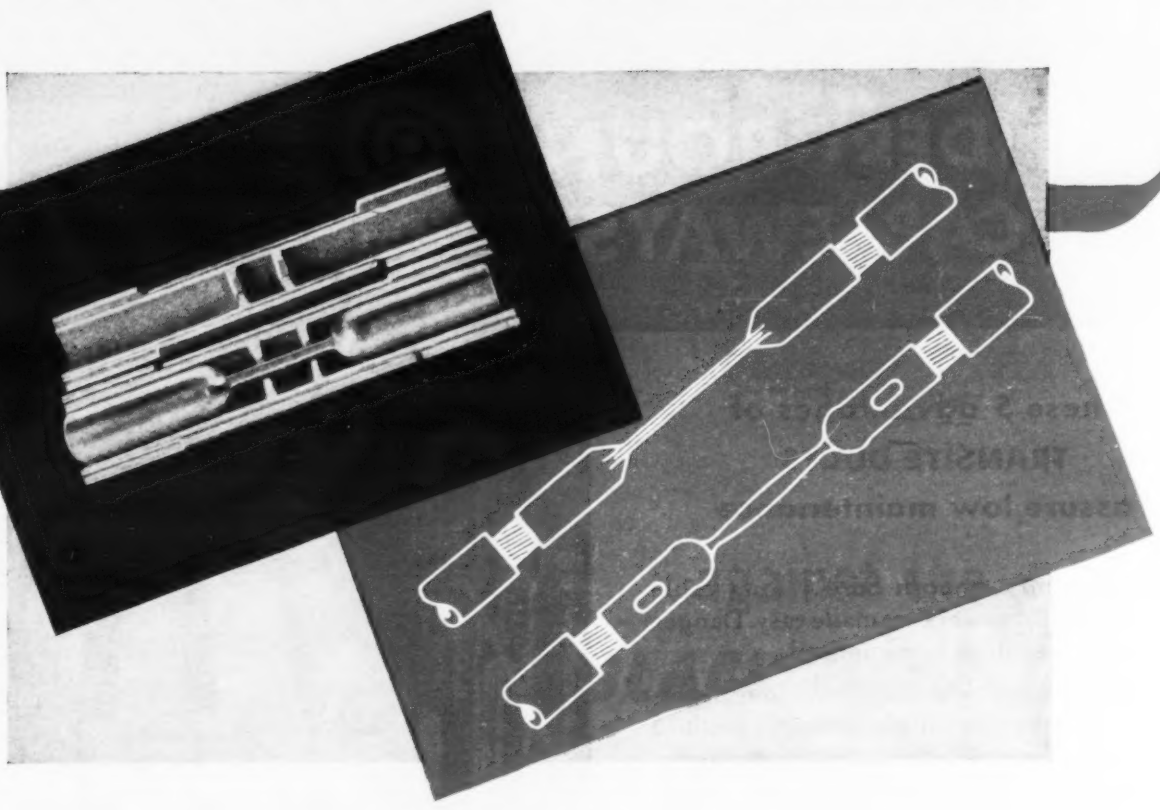
The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10, Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.)

DUTCH BOY RED LEAD

SHELDON KOMPRESS LIMITERS

The "Stop Sign" Shorts Obey!



IT'S COMMON TODAY to have larger loads and smaller crews. That's why service interruptions must be kept to a minimum. And when your underground secondary network distribution system is fully protected by SHELDON KOMPRESS LIMITERS, you're sure of saving man-hours . . . *plus* eliminating costly replacement of facilities . . . *plus* building up customer good will through uninterrupted service.

SHELDON KOMPRESS LIMITERS are specifically designed to give complete, positive protection to entire network systems against electrical faults due to short circuits. They isolate short circuit currents by preventing their spreading away from the fault . . . thereby eliminating extensive damage such as burned cable insulation, destroyed equipment and service interruptions.

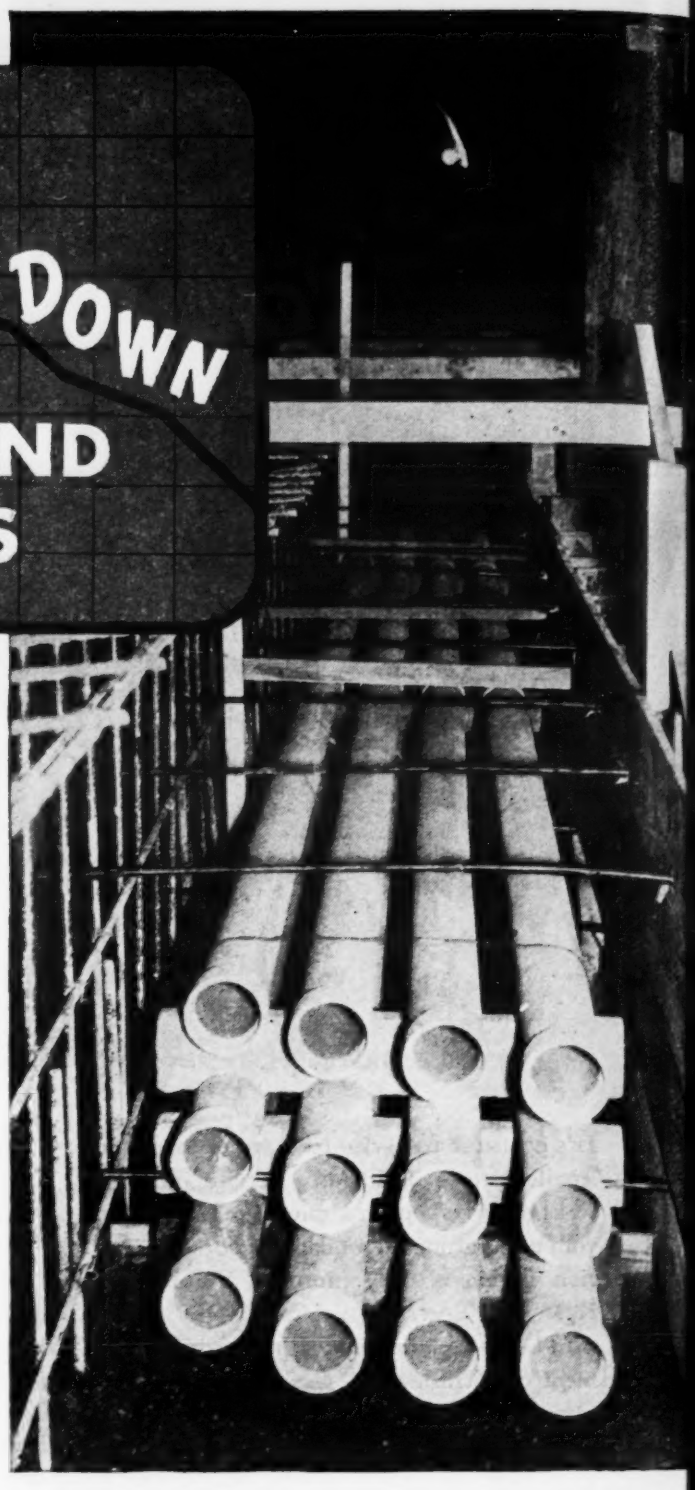
Precision manufactured . . . made of 98% conductivity copper . . . SHELDON KOMPRESS LIMITERS are pressed onto your cables. Solder is eliminated. Limiter features are also built into SHELDON Lugs, Crab Joints and Network Protector Terminals. In use by many of the country's leading utilities. Types and sizes for every requirement. Write today for complete data and prices. Sheldon Service Company, 652 Hudson Street, New York 14, N.Y.

Specify "Sheldon" for Precision-Built Electrical Connectors

SHELDON SERVICE COMPANY

SPLITBOLTS . . . LUGS . . . COUPLERS . . . LIMITERS . . . CRABS

UPKEEP GOES DOWN with these UNDERGROUND CABLEWAYS



These 5 advantages of TRANSITE DUCTS assure low maintenance

1. *Permanently smooth bore*...long cable pulls and replacements are made easy. Danger of damage to cables is minimized.

2. *Easily and quickly installed*...long, lightweight lengths and simple assembly method assure rapid, economical installation.

3. *Inorganic*...made of asbestos and cement compressed under great pressure. This provides permanence and strength...makes these ducts immune to rust and rot.

4. *Immune to electrolysis*...being entirely inorganic and non-metallic, Johns-Manville Transite Ducts are not affected by electrolysis or galvanic action.

5. *Incombustible*...won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur, these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

For complete details on J-M Transite Ducts, write for Data Book DS-410, Johns-Manville, 22 East 40th Street, New York, N. Y.

TRANSITE KORDUCT *above*—for installation in concrete. Thinner-walled but otherwise identical with Conduit.

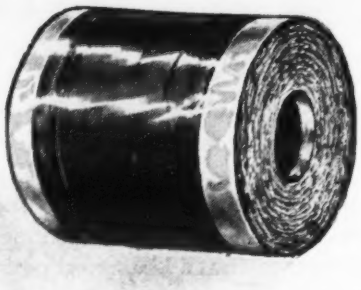
TRANSITE CONDUIT—for exposed work and for use underground without a concrete encasement.

Johns-Manville

TRANSITE DUCTS

JM PRODUCTS

LUMARITH* C.A. provides a "Safety Curtain"



against the BLACK HAND OF CORROSION

LUMARITH C.A. (cellulose acetate) insulation is effective protection against electro-chemical corrosion, the greatest cause of electrical failure. It is another example of how synthetic materials can frequently do a better job than natural materials, because they can be created from the start to meet definite objectives.

Lumarith C.A. is not subject to the built-in hazard of organic decomposition. It resists moisture and contains no substances which combine with moisture to form free acids. Applications involving fine wire, humidity and direct current are particularly well served by Lumarith C.A. insulation.

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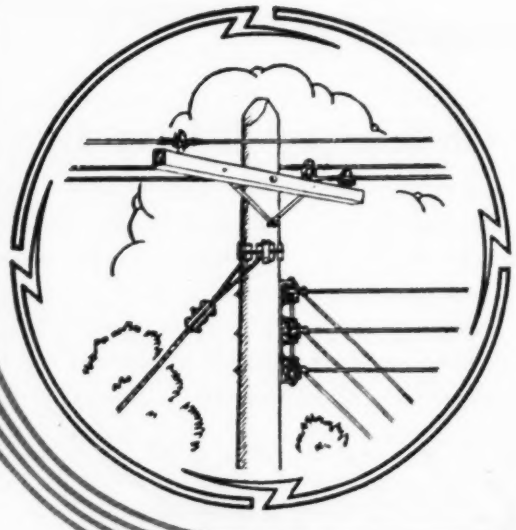

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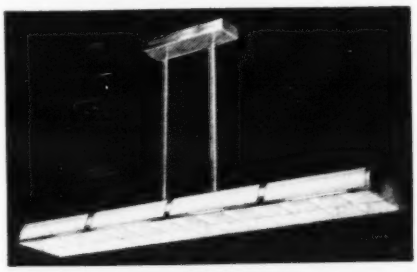

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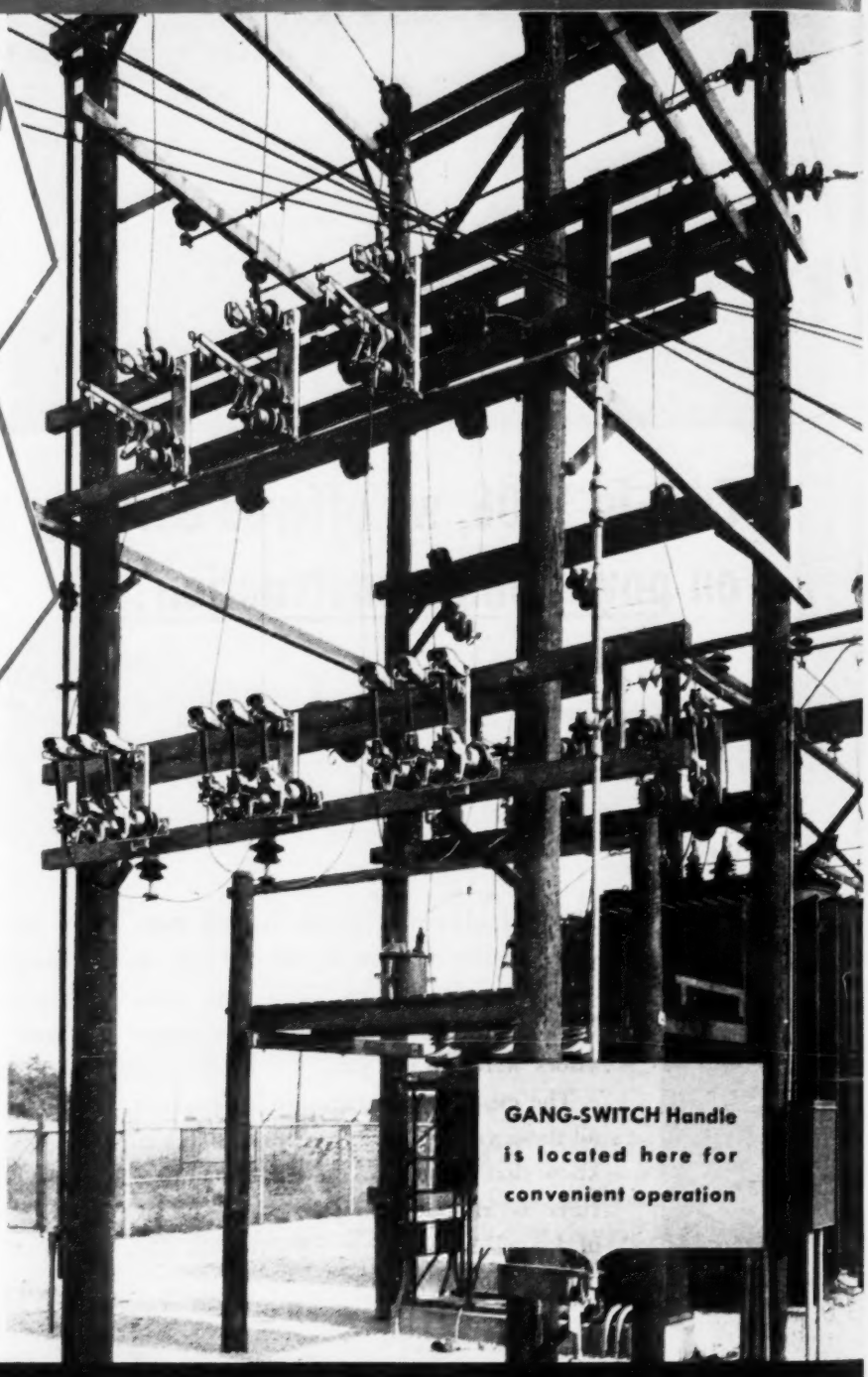

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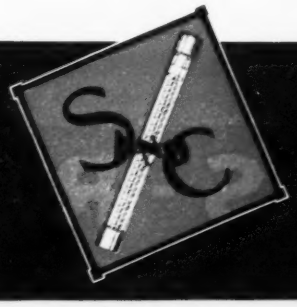

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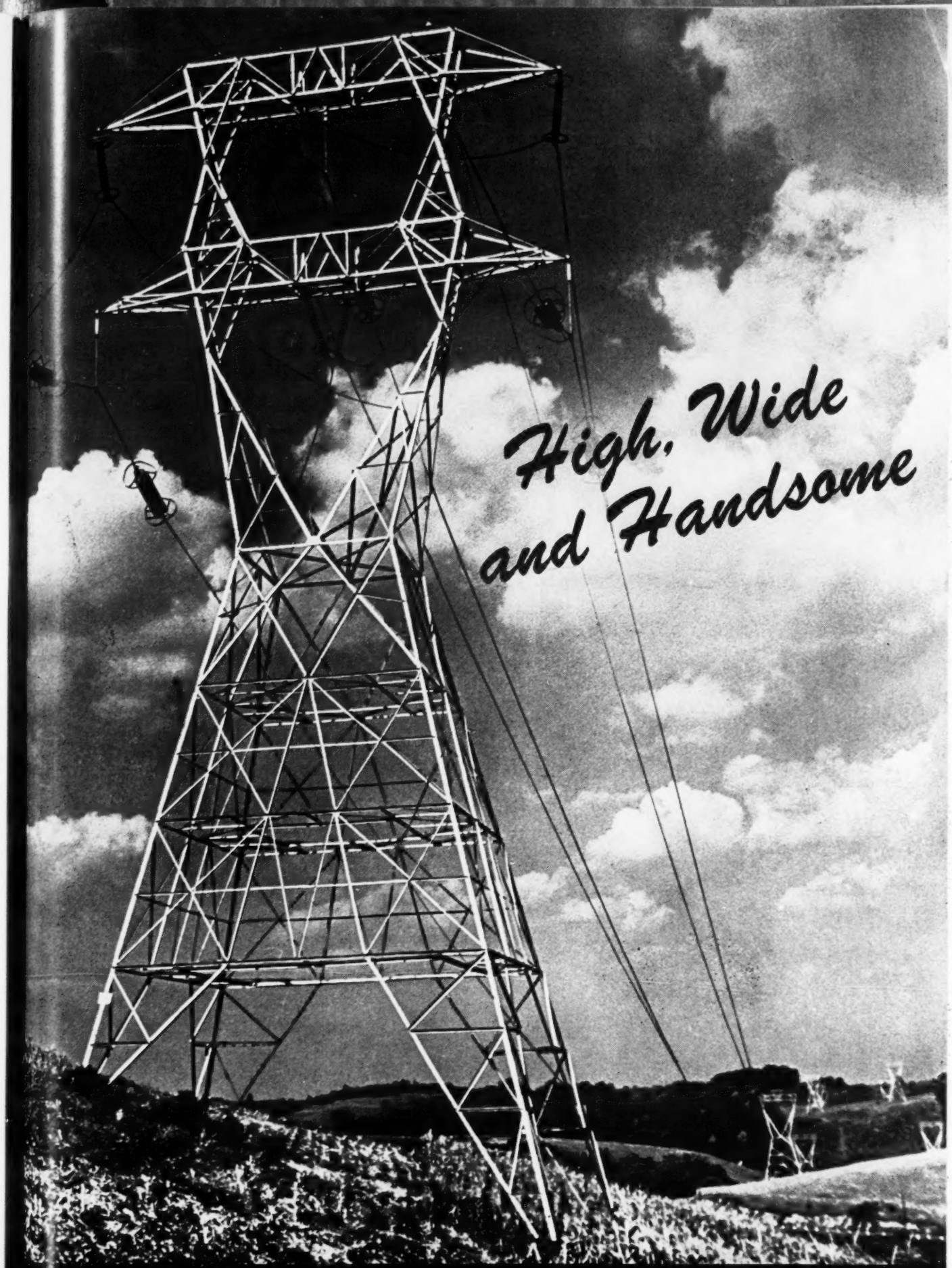

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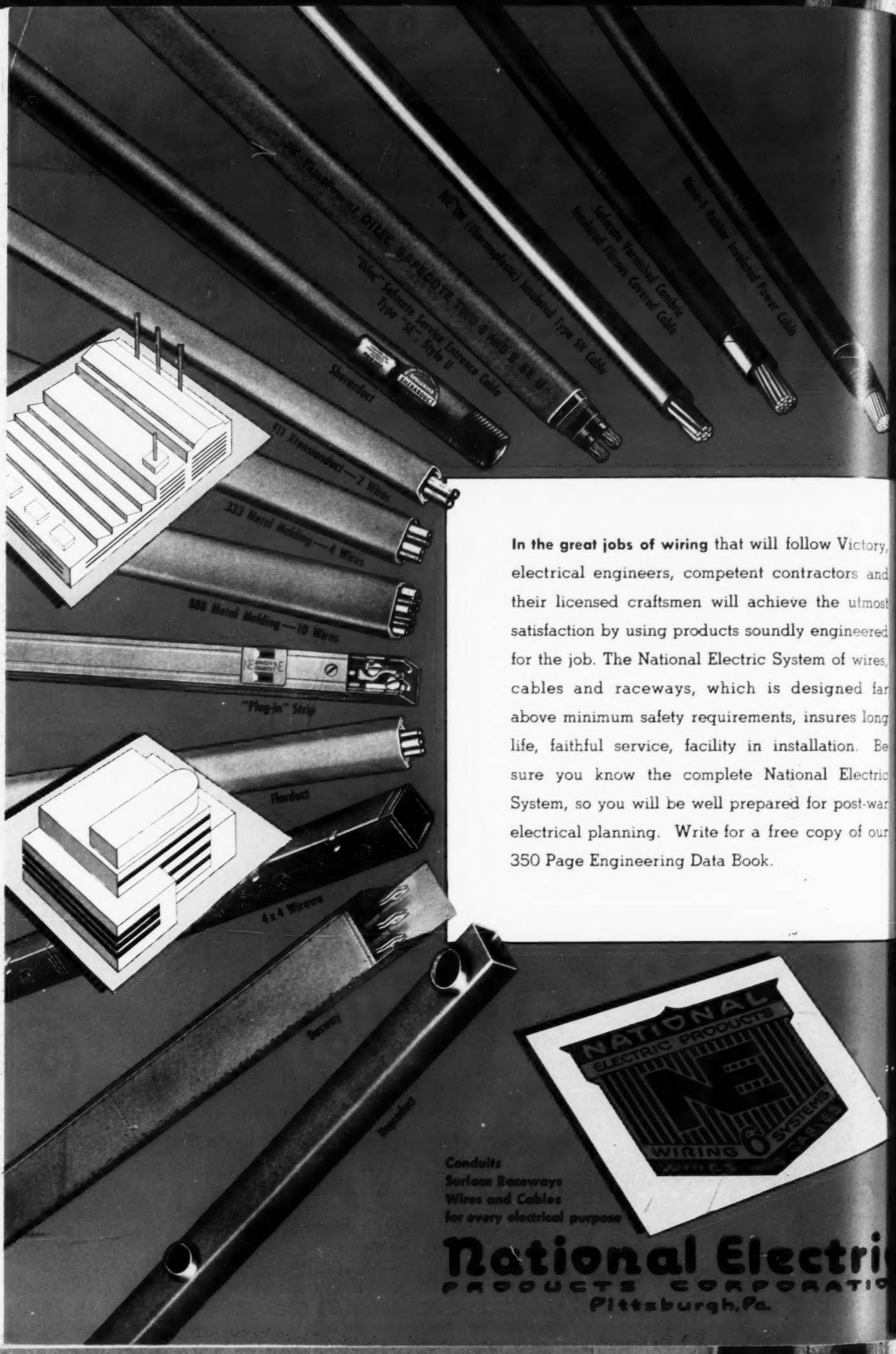

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Electrical World

MARCH 17, 1945

Does Congress Know?

FROM TIME TO TIME some member of Congress rises to pay a compliment to American railroads for a splendid war-time job. Only two weeks ago a representative from Minnesota had a fine editorial from the *Christian Science Monitor* on the performance of the rails inserted in the Congressional Record. We couldn't help thinking how often praises of the railroads are on the lips of people and how seldom do they think of the electric utilities except to be critical.

As the previous Congress was drawing to a close and the MVA was being debated, one southern senator did praise the electric utilities of his state only to bring forth denunciation of power companies by senators from other states. Only one senator could and did say something good about power companies.

The Army and the Navy and the Office of War Utilities know what the power industry has done to bring victory, but apparently members of Congress don't know or if they do they are strangely silent, having delivered themselves of encomiums of many other industries.

Does Congress know that there has never been a shortage of power—that no war industry has had to shut down because there wasn't enough capacity? England has frequently had to ration power because it didn't have enough capacity to take care of the peaks, but not so over here.

Does Congress know that except for one or two unauthorized strikes there has been no curtailment of power output due to labor difficulties? This is a great tribute to the employees of the power industry but is it not also a great achievement on the part of utility management?

Does Congress know that the power industry last year delivered twice the amount of electricity it did in 1938 with but a quarter more generating capacity? Yes, and with 25 percent fewer employees?

Does Congress know that no one had to stand in line to buy kilowatt-hours, that there was no rationing of this basic raw material or priorities—all were served according to their desires, day and night, winter or summer and served instantaneously?

Does Congress know that the brownout order and the night club curfew are not caused by any shortage of electricity? That the utilities generally had plenty of fuel because they were about the only sector of American industry to protect their service with adequate stockpiles of coal and that a good bit of the shortage in the national fuel supply will probably come out of the power company coal piles?

Does Congress realize that the flow of virtually every other raw material can stop for days or be intermittent and still the war production effort will continue virtually unabated, but let the flow of electricity stop for but one minute and war production ceases? The point is that it didn't stop.

Maybe Congress doesn't know all these things and more because nobody has told it. Maybe if Congress knew it might be less inclined to be critical and punitive the next time a utility issue came before it.

Maybe it would be a good idea for the industry to tell Congress some thing sometime and then to keep on telling fact-by-fact.

Circulating-Water Turbine Gives Freedom to Plant Location

Effective recovery of energy used in pumping condensing water to above flood level demonstrated in design and performance of new R. E. Burger steam plant on Ohio River—Seven extractions, accumulator for soot-blower supply, low draft loss boiler are other departures

G. W. SAATHOFF, Electric Advisers, Inc., New York*

AN HYDRAULIC TURBINE driven by discharged circulating water is a distinctive feature of The Ohio Public Service Co.'s new R. E. Burger steam-electric plant located well above Ohio River flood level at Dilles Bottom, Ohio. Analysis showed this novel procedure to be fully substantiated. It is available as a tool to broaden the latitude in choosing plant elevation and location.

Other departures in this development are the use of seven extraction points on the 60,000-kw. (output capacity) General Electric turbine, an accumulator provided for flash supply to sootblowers, low-draft-loss boiler, condensate pump designed for low headroom and cold storage of condensate.

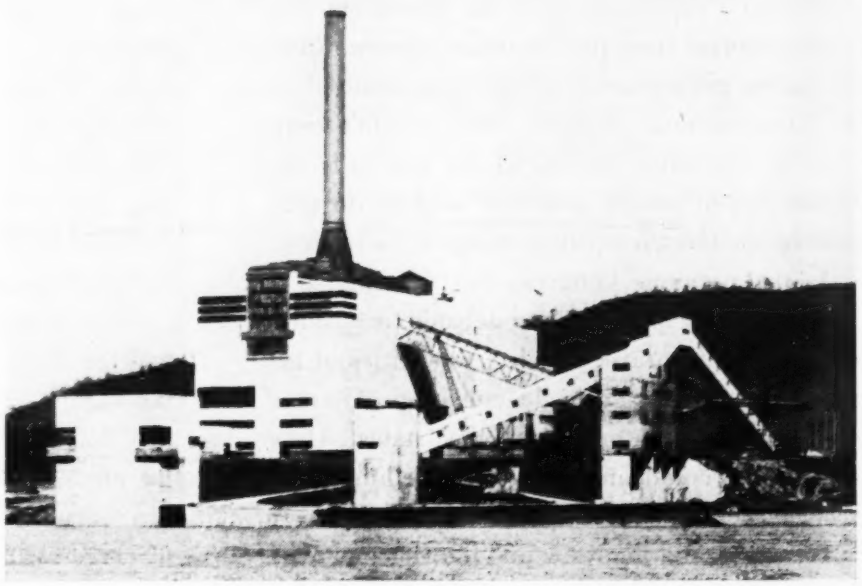


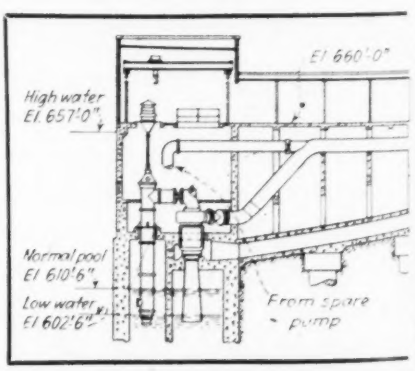
FIG. 2—View of Burger plant with river at approximately 25-ft. flood stage. (Artist's drawing on cover shows elevation of plant at normal river level)

Above Flood Level

At the plant location the record flood rise has been 57 ft. The plant has been placed so that the "basement" floor level is 3 ft. higher than that, and everything but the lower half of the condenser and the circulating water pumps is above that 60-ft. level. Except for possible flood period interference with supply of coal the plant is capable of operating through any expected rise. In this respect the pumping of circulating water against what is a substantial head for all but the flood period of each year affords great latitude in selecting the location of the plant, at least insofar as elevation is concerned.

Analysis of several alternative designs indicated that lower substructure cost and avoidance of the construction hazards incurred with a plant placed at river level would, in itself alone, warrant the higher power pumping. This was found to be the case even though no effort be made to recover any of the pumping energy. Unforeseen behavior of the river during the construction period could easily cause costly delays and even the repeating of some construction operations. Placing the plant above flood level would reduce to a minimum the facilities needed to be constructed at or below normal river level.

Quite naturally, the high-level location of the plant would be even more persuasively established if it should prove feasible to install a turbine in the rejected circulating water line and have it drive a booster pump to aid the main pump. J. A. Bjerregaard of Electric Advisers, Inc. had explored this technique in a preliminary way with hydraulic engineers of the Allis-Chalmers Mfg. Co. as early as 1927.



* Vice-President in Charge of Engineering, Design and Construction.

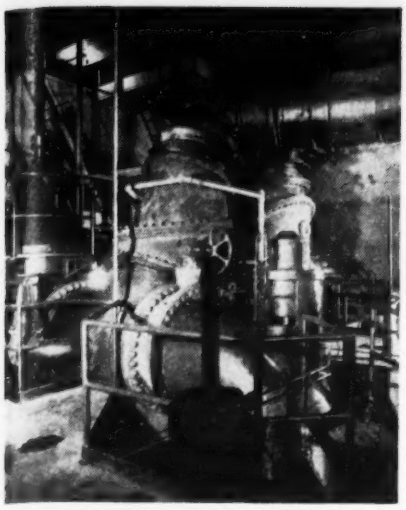


FIG. 3—Motor-driven circulating pump (in left background) with motor on floor above. Inlet (center) to hydraulic-driven booster pump

Particular emphasis at that stage was placed on the control aspects. Further studies just prior to decision on the details of the Burger Station, in conjunction with engineers of Worthington Pump & Machinery Corp. led to modification of the earlier control arrangements. In this way a satisfactory solution was found for this particular head and location.

Generation of electrical energy by means of an alternator driven by the circulating water turbine would probably prove to be a prohibitively expensive procedure. The 55,000 gallons per minute required (for full condenser supply at full output) against head of 60 to 68 ft. net static (plus allowance for condenser and duct friction) would necessitate a motor of 1,000/1,100 hp. for the main pump and about a 500-hp. turbo-generator. The actual installation has, however, a motor of 600 hp. driving the main circulating water pump and a 500-hp. hydraulic turbine in the discharge line driving a booster pump in series with the main pump. Working alone the 600-hp. main pump is capable to delivery 60 percent of the full-flow circulating water requirements. The remaining 40 percent is supplied by the turbo-booster.

Efficiency and Economy

Combined efficiencies of the hydraulic units are such that 70 to 80 percent of the power otherwise wasted due to the high-level location of the plant is recovered. Maximum efficiency of the setup is, of course, obtained at lowest river stages. Actual performance indicates that flow through the condenser is at design value with minimum level of river and up to 5 percent more at higher river stages. Electric power input to the motor-driven main pump has proven to be practically constant under all river conditions encountered.

Characteristics of the pump and hydraulic turbine are such that level in the control tank is stable; in fact, the factors in the pump system are such as to be self-compensating and control is no problem.

The installation involves only a moderate increase in pumping head as compared to one for a comparable

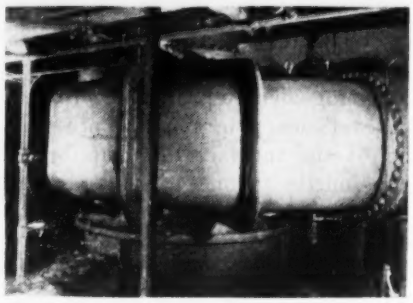


FIG. 4—Volute of hydraulic-driven booster pump for circulating water

low-level plant. Including the condensate pumps and the house supply pumps with the circulating water system, the difference in power requirements is less than 100 hp. These comparisons are based on allowance of 12 ft. of added head to cover tunnel and duct friction for a low level plant. This adverse difference in power requirements is actually more than offset in economic value by the elimination of a long condenser exhaust connection including the necessary expansion joint.

In other words, at normal river stages the circulating-water turbo-booster recovers about 425 hp. net. This reduction in auxiliary power requirements more than justifies the expense of recovery equipment.

Incidentally, the monthly average auxiliary power for the entire plant is 3.8 percent. This includes plant lighting and is based on operation of one boiler feed pump on steam. This low magnitude of auxiliary power is for the single unit installed and can probably be bettered when subsequent units are added.

In effect there are seven points of extraction. Three of these are in the

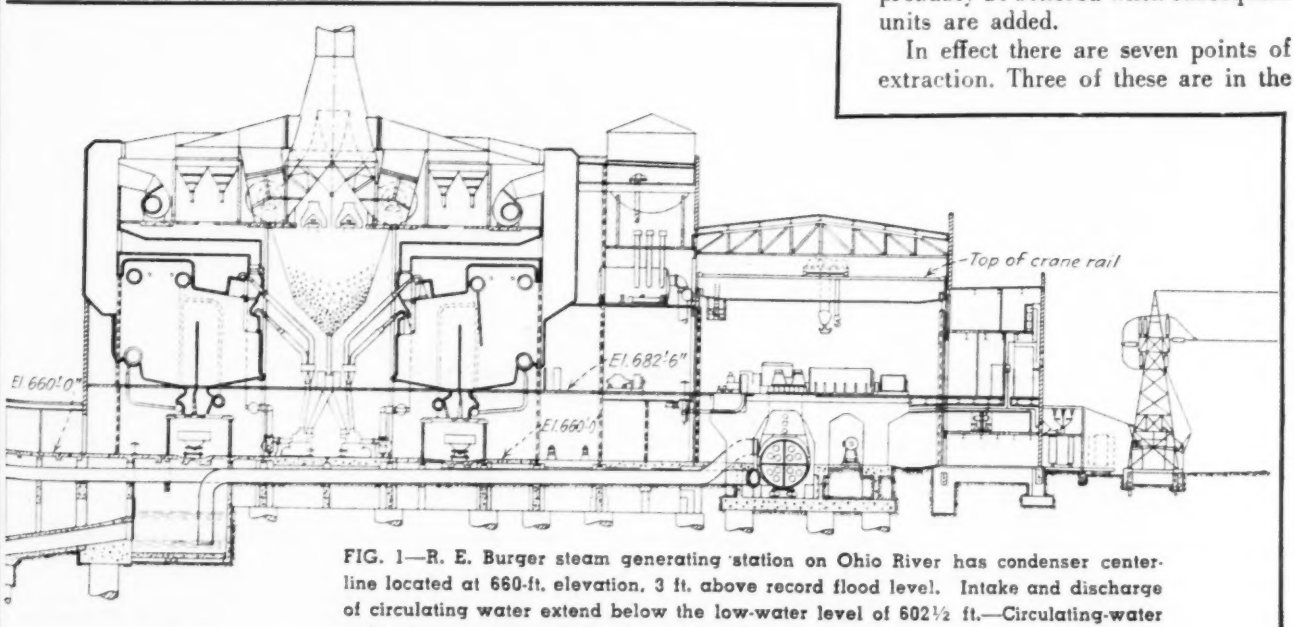


FIG. 1—R. E. Burger steam generating station on Ohio River has condenser centerline located at 660-ft. elevation, 3 ft. above record flood level. Intake and discharge of circulating water extend below the low-water level of 602½ ft.—Circulating-water turbine acts as pump booster at other than flood periods

low pressure end of the turbine, at 12, 6.8 and 3.2 psi. absolute. Without giving effect to probable increased blade efficiency in the low pressure end of the turbine, they support a three-fourths to one percent gain in output capacity of the plant at the coupling and a three-fourths to one percent reduction, therefore, in fuel consumption. The three did not cost enough more than a single extraction to prevent deriving an additional capacity of 500 kw. at about one-tenth the outlay per kilowatt for the plant as a whole.

It was found feasible to put these heaters directly in the throat of the condenser where velocity of steam from the turbine exhaust is advantageously low. Tests have shown very little impedance to the flow in the instance of this double-flow machine.

At the high pressure end of the turbine there are six extraction heaters arranged in two pairs of three each; one group for each of the two 350,000-pound per hour boilers. They are piped on the water side as if they were two sets of 6-pass heaters. The cost is admittedly greater than for conventional installations but the difference is small for the gain effected.

The heat balance diagram as shown represents the expected plant results for continuous operation under the present conditions of loading as required in the Ohio area. In the interest of conservation of critical materials, at the request of the War Production Board, the plant is now operated without economizers, with steel tubes in the high pressure heaters, and with 7 percent of the condenser surface temporarily omitted. After making allowance for these

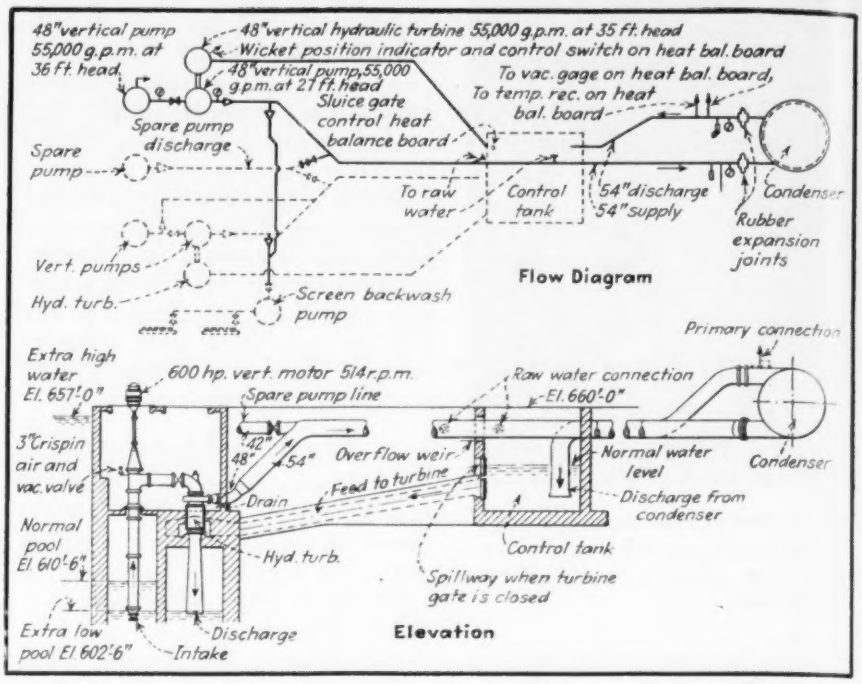


FIG. 5—Pump and turbine layout including control tank, by-passes, weirs and screen back wash for circulating water system

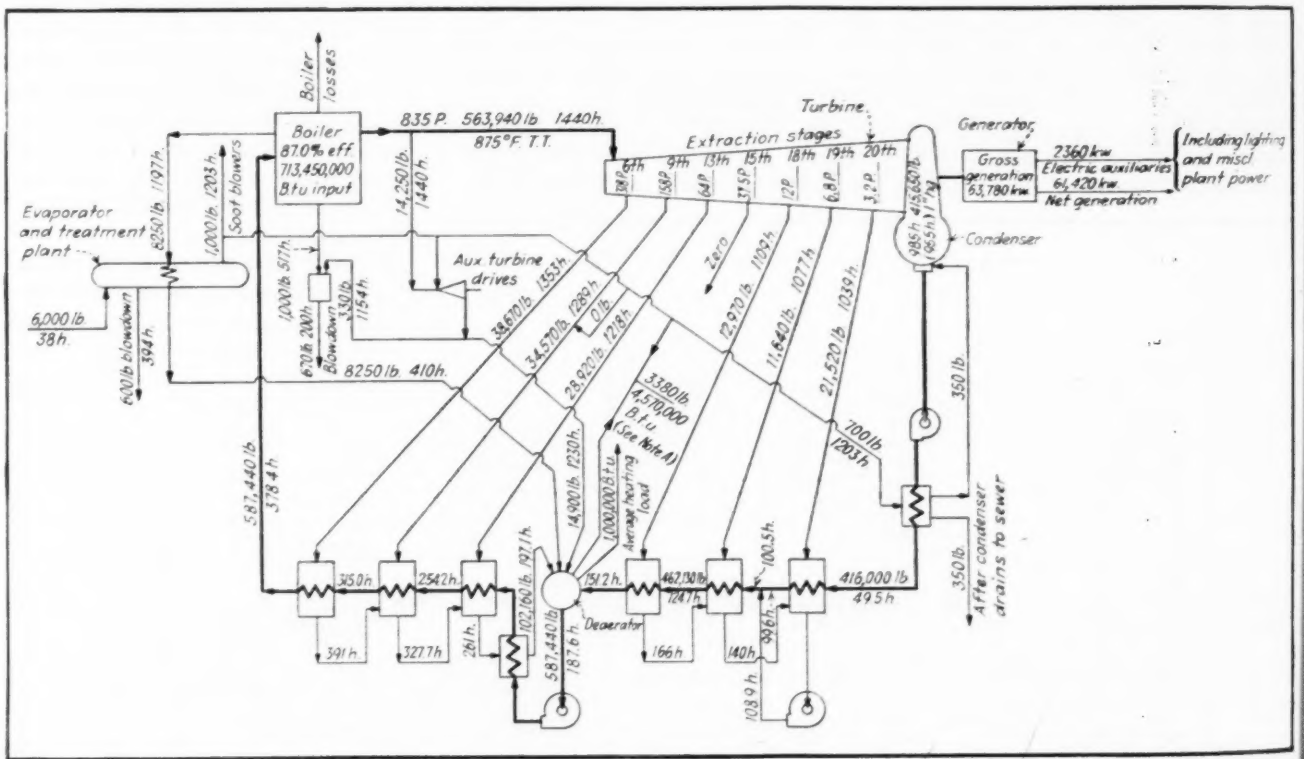


FIG. 6—Seven stages of extraction provided in conjunction with 60,000-kw. turbo-generator.

Expected results shown for continuous operation. Plant heat rates (with 87 percent boiler efficiency); 850 deg. F. total temperature, 11,714 B.t.u. per kw.-hr. net generation; 875 deg. F., 11,616 B.t.u.; 900 deg. F., 11,518 B.t.u.; with economizer 88.5 percent boiler efficiency, 11,323 B.t.u. P = pressure in psi. absolute. lb. = flow in pounds per hour. h = enthalpy, B.t.u./lb. Note A = miscellaneous plant losses, including radiation, vent losses, etc.

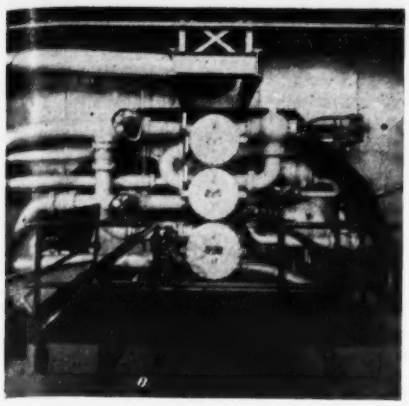


FIG. 7—Water and drain piping for three low pressure heaters installed in connection between turbine and condenser

items, as well as the lower quality of coal made available during the war period, the plant is operating substantially in line with expectations but with somewhat higher output capacity.

Soot blowing was foreseen to be more than ordinarily troublesome because of the high sulphur content of the coal burned. The blower manufacturer specified a supply of 350 psi. saturated steam; this is customarily obtained by tapping the steam-drum. But taking such a heavy short-time draft of steam directly from the boiler drum upsets the boiler regime and disturbs all the automatic controls.

In this plant an evaporator was modified to make it, in effect, become an accumulator with flash characteristics. Instead of drawing steam for soot-blowing at a rate of from 22,000 to 25,000 pounds per hour the accumulator functions at an equivalent draft of a 1,000-pound rate. It was found that the accumulator could be incorporated in the evaporator design without material increase in cost by eliminating customary heavy bolted head construction for evaporators.

Boiler

Each of the two 350,000-pound per hour, 900 psi., 900 deg. F., Babcock & Wilcox boilers is of the single-pass type with one open pass. They are designed for minimum height and minimum draft loss. Actual draft differential at 350,000 pound per hour output is 3.6 in., covering furnace, boiler, superheaters, air heater and dampers. Most of the credit for the low draft loss goes to the open pass and single pass factor.

The primary furnace has burners at two levels. Wet bottom operation usually results with operation of the lower banks of burner. Under the conditions of lighter loads and of coals with high ash-fusion temperature the upper burners are used and dry operation usually is attained. The upper set can also be used to correct any interruption of the lower burners due to plugging, any unbalance in temperature distribution or variation in feed from pulverizers.

The convection section is arranged with tubes in staggered arrangement rather than in straight laning. No tubes have had to be replaced in this section in any of the plants where this was done as early as 1938. Fear of difficulty in replacing burned-out tubes is not supported by the experience on which the boiler design was based. Desired gain in efficiency is attained without resort to an economizer.

Two boiler units per turbine were used in place of one because of the expected increased availability of the unit as a whole. The increased yield of low cost energy over a single boiler unit should be more than enough to justify the difference in cost.

Fans

The induced draft fans (Sturtevant) are dual-driven by motors (General Electric) of 250 hp. (600 rpm.) and 400 hp. (720 rpm.); control is coordinated with inlet vanes. The forced-draft fans are likewise dual-driven the motors being 150 hp. (900 rpm.) and 300 hp. (1,200 rpm.). The Hagan control of these fans and the boiler is actuated by air-flow measurements from piezometer ring in the median line of a special inlet to the Sturtevant forced draft fans. It has been demonstrated that the measurement at this point by means of piezometer rings affords a sufficiently accurate base upon which to erect a control system.

Prat-Daniel dust collectors have been installed principally to keep the plant clean and save the induced-draft fans from undue wear and excessive maintenance. Because of the high sulphur content of the coal no attempt was made to reduce stack heat losses beyond the point where increased investment in conjunction with the increased maintenance would offset the economic value of the B.t.u. conserved.

Headroom was limited at the pump level and consequently the condensate pump was built as if it were to function as a sump pump and placed in a hot well extension. By this means it was possible to have a 3-ft. lower ceiling for the basement without sacrificing any submergence. This had worked out well at The Toledo Edison Co.'s Acme station. In both instances the pump is suspended from a sort of manhole cover over the hot well.

Instead of storing the condensate hot a supply for replenishment is kept in a cold state in a surge tank. If demand for condensate exceeds the delivery from the condensate pump some of this cold makeup from this source is introduced between second and third heaters.

Design and construction was under the author's direction. Detailed design of substructure work and river protection, as well as the coordination of other features of the complete plant, were carried out by the engineers of Electric Advisers, Inc., in conjunction with the operating engineers of the Ohio Public Service Co. The rest of the detail design was carried out by Gibbs & Hill, Inc.

Acknowledgement is made to the assistance by engineering staffs of the several equipment manufacturers, particularly Worthington Pump and Machinery Corp. in working out the hydraulic details of the circulating water system and the engineers of the Foundation Co. in connection with the use of reinforced concrete caissons sunk from ground level to rock for practically all the substructure as well as river protection and pump house.

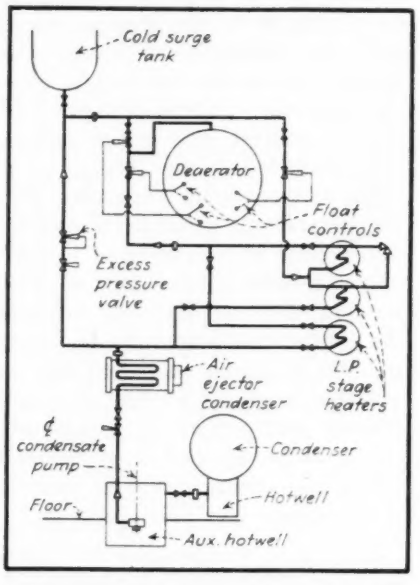


FIG. 8—Condensate stored in cold sta in surge tank

Remove Neutral Cable from St. Louis D. C. System*

Interbond d.c. and a.c. network neutral at manholes and remove neutral cable from d.c. system in downtown area—Cable sheaths and a.c. neutral provide sufficient capacity for both systems without separate d.c. neutral cable—Project justified economically

A. BODICKY†, Union Electric Co. of Missouri, St. Louis, Mo.

INTERBONDING of d.c. and a.c. network neutrals, permitting the removal of neutral cables from much of the underground d.c. system in downtown St. Louis has made it possible recently for the Union Electric Co. of Missouri to remove, salvage and scrap 60,000 ft. of cable aggregating 138,000 lb. of copper and 150,000 lb. of lead.

Thus far, no adverse conditions have been encountered which could be associated with interbonding of the two system neutrals, either during normal operation or during d.c. cable failures or manhole fires. Moreover, the entire project was economically justified.

During the turn of the century the low-voltage a.c. network system then existing in downtown St. Louis was supplanted by a d.c. system. Along with the installation of substations, feeders, auxiliaries and mains, a single-conductor paper-insulated lead-covered neutral grid was established and reinforced as new substations or large services were connected. The d.c. neutral was grounded to the station ground at each of seven 115/230 volt d.c. substations. At two other straight 230-volt stations, however, the neutral was not available. When, in 1938 it became apparent that requirements of service for air conditioning and other a.c. equipments could not be supplied from the small radial a.c. system a regular a.c. network system was developed.

Up to the present time the network load has increased to 19,000 kva. without material reduction in d.c. load. However, it is expected that the d.c. load will gradually decrease with greater use of fluorescent lighting, air conditioning and other modernizations.

Sheaths Efficacious

Since the bare a.c. network neutral is connected to the bonding system in each manhole, the lead sheaths of all d.c. and other cables greatly augment the neutral capacity of the system. When the copper shortage was at its height an investigation was made as to the feasibility of utilizing the 4/0 a.c. neutral for both systems.

Investigation revealed no conclusive reason why the d.c. neutral should not be interbonded in manholes. The seven low-resistance grounds at the substations had caused no visible effect on the system. It was felt that additional grounds in manholes would not materially affect the operation of the neutral system. This experience with the d.c. station grounds, and no doubt many undiscovered accidental grounds, indicated that few unfavorable conditions would be encountered. Corrosion failures experienced were always localized within a few feet of the faulty grounded negative conductor, creating a concentrated positive area. In one instance when a steel hull on the Mississippi River was welded directly from our d.c. system, using the negative side as an electrode and the neutral as a ground, a positive condition was obtained in an area about two city blocks from the river and six blocks parallel with it. Although no damage occurred to any of the underground structures, polarity was reversed and later an m.g. set was employed.

In general, neutral capacity to serve both the a.c. and d.c. networks was designed to provide, in sheath and neutral conductors, about half the capacity of total circuit conductors with due allowance for balanced loads. The d.c. neutral system was checked on the basis of this and where sheath capacity plus the a.c. neutral and the d.c. neutral in the d.c. main were adequate, the separate d.c. neutral cable was removed. Separate neutrals into the substations and those associated with large d.c. services were left in place to the respective switchboard and interbonded in the manholes.

At a Railway Substation

In the western section of the downtown area heavy d.c. street car current, concentrated around a street railway substation, made it desirable to leave the d.c. neutrals in place and interbond them to reduce current densities on the cable sheaths. Some stray current was found to have collected on phase wires of the a.c. network system near this street railway substation. It amounted to 217 amp. of d.c. flowing through each phase of a nearby 500-kva. network transformer and returning through the neutral and sheaths to the street railway substation negative bus. After neutrals

* From a paper "Removal of D.C. Neutral Cables" presented by the author before the Transmission and Distribution Committee of E.E.I., February 15, 1945.

† Underground Engineer.

were interbonded at each manhole, stray current through the network transformer was reduced to 171 amp.

Work was started at each of the 228 manholes by bonding all neutral conductors from mains, services and separate neutrals that were to be left in place to the existing manhole bonding bus that had previously been established to interbond all cable sheaths and a.c. neutrals. This bonding bus is not grounded except through the a.c. neutrals, cable sheaths, at the a.c. network vaults and at customer's premises. At substations of large service connections, one or more 4/0 copper neutral connection was provided, one for each 500,000 cir. mil of existing neutral size. To equalize the current flow on the bonding bus the various 4/0 d.c. neutrals were spaced so that either three No. 2 cable sheath bonds or one 4/0 a.c. neutral bond were between adjacent connections. Where two or more 4/0 wires were installed from one large d.c. neutral to the manhole bonding bus, the lengths of wires were equalized as nearly as possible.

To prevent moisture from entering joints of the d.c. mains, a solid 4/0 wire was spliced to the standard neutral, wiping the copper and lead sheath together and thereby sealing the end of the cable. All connections were soldered. To insure the continuity of the neutral on customer's services, temporary jumpers were employed.

Work was started in the fall of 1943 and completed in six months. In all 60,000 ft. of single-conductor cable was removed; the majority in sizes ranging from 500,000 cir. mil to 2,000,000 cir. mil. Since these cables were old, all were scrapped, thereby salvaging 138,000 lb. copper and 150,000 lb. lead. On removing neutral cable, numerous lead burns and breaks in the lead sheath were discovered. Copper burns also were discovered which no doubt resulted from previous cable fires. The material used in carrying out the project consisted of approximately 2,600 lb. of 4/0 wire and 800 lb. of solder. A large quantity of this material was required to replace some of the old corroded bond wires in the manholes which could not be cleaned properly for soldering.

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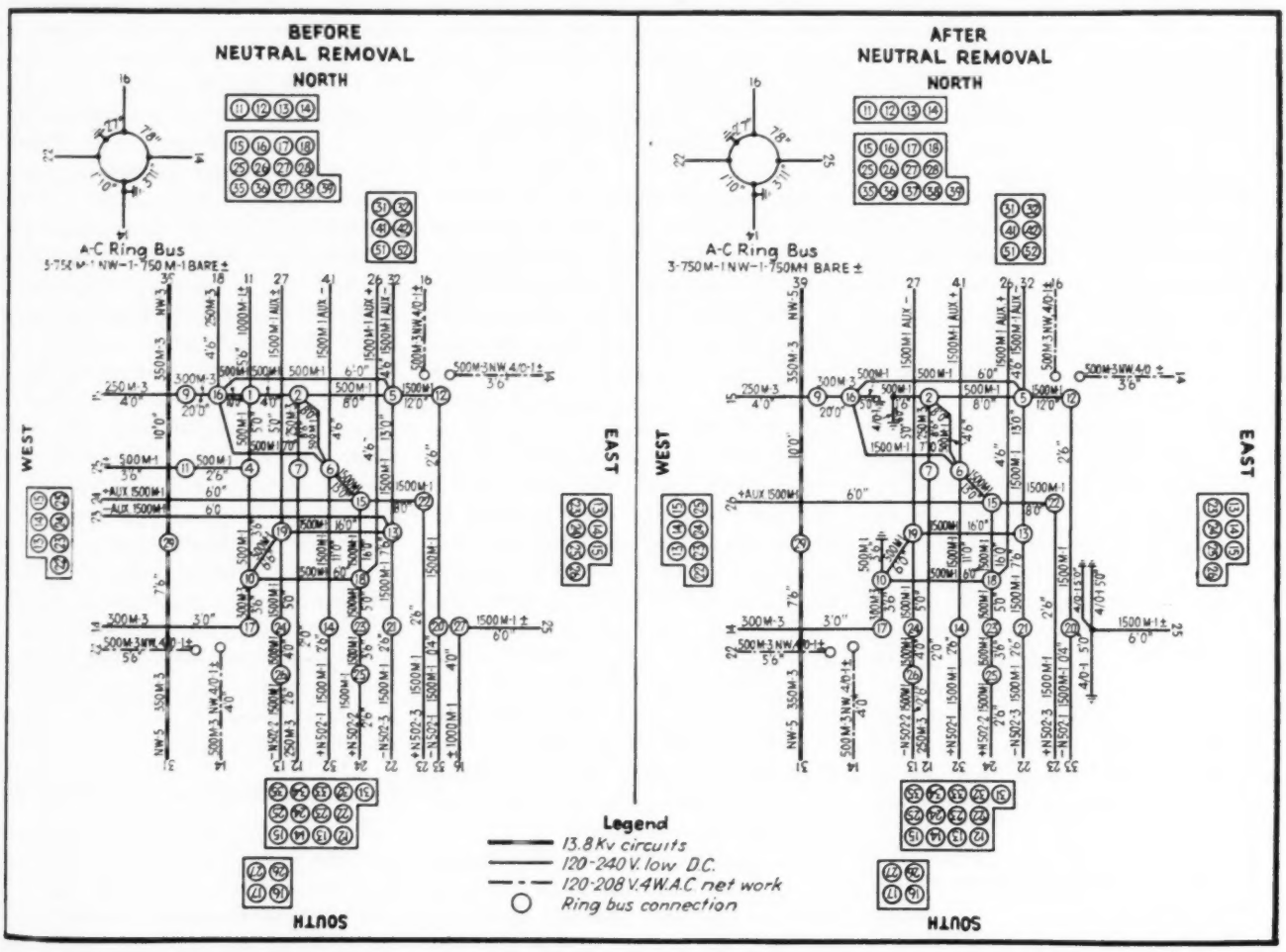
Great Hydro Resources in Latin America

Latin American countries with potential hydroelectric resources of 55,800,000 hp. have utilized but 1,519,400 hp., the Office of the Coordinator of Inter-American Affairs reports.

Brazil with resources of 20,000,000 hp. has utilized 700,000 hp., the most of any of the countries; Uruguay has no hydro installations.

Existing and utilized potentials are given in the table in horsepower:

Nations	Existing	Utilized
Central America	5,000,000	105,200
Argentina	5,000,000	35,000
Bolivia	2,500,000	13,500
Brazil	20,000,000	700,000
Chile	2,500,000	114,000
Colombia	4,000,000	25,000
Ecuador	1,000,000	6,400
Mexico	6,000,000	450,000
Paraguay	2,000,000	300
Peru	4,500,000	55,000
Uruguay	300,000	.....
Venezuela	3,000,000	15,000
Total	55,800,000	1,519,400



CONNECTIONS BEFORE AND AFTER interbonding a.c. and d.c. neutrals and removing d.c. neutral cable at a typical manhole

Speed and Load Control on Interconnected Systems—I

Power pool engineer explains phenomena which occur each time a change in system load occurs—Subsequent installments will discuss: requisite characteristics and adjustments of governors; control of frequency and load; operation of regulating capacity

E. E. GEORGE, Electrical Engineer, Ebasco Services Inc., New York

THIS DISCUSSION is an attempt to explain in simple terms the operation of speed and load-control devices on a power system. There are many influences involved in speed and load control, and some of them work in opposite directions. It is impossible to understand system operation without some idea of the relative importance of various factors. The factors discussed herein are those which experience has shown to be of primary importance in bringing about improved operation.

Diagrams herewith give a picture of the effect of load increase on system performance. Effects are shown in simplified form compared with actual conditions in order to bring out the fundamental relations. Actually some of these quantities have reciprocal, differential, or integral relations to the rates of change of the other quantities, with consequent tendency to oscillation and overshooting before a balance is finally reached. If it is borne in mind that power system operating characteristics have to be considerably simplified in order to use a differential analyzer or an a.c. calculating board to determine the relations between power system acceleration, phase angle, and kinetic energy, it will be realized that there are limitations in such simple diagrams as those shown herewith.

Cause of Frequency Change

There is no tendency for system frequency to change as long as there is equality between the total power consumed and the total power generated.

During normal operation, small differences between load and generation occur slowly but almost continuously. This is more pronounced in the early morning, at noon, and after the night peak. During trouble in lines or equipment large unbalances may occur suddenly between load and generation.

When the equality between load and power input to the turbine is destroyed, there is a change (not instantaneous) in system speed and frequency which takes place as follows: Assume a lamp or other load is turned on and almost instantly begins to draw power from the generator as shown by the sudden sharp increase in load on the upper curves of the illustration. (This change in power output of the generator requires a coincident increased lagging of the generator terminal voltage behind the internal voltage or shaft position of the generator in order to force the additional power through the generator internal reactance. Note the rapid change of phase angle on the figure shown.) Since there is no *coincident* change in the power input to the turbine, the additional energy represented by the increase in generator output must be drawn from the stored or kinetic energy of the generator and turbine.

The only way in which this stored energy may be withdrawn is by a reduction in the physical speed of the unit, the amount of energy withdrawn during any given interval being proportional to the difference in the square of the speed at beginning and end of the interval. Thus, as long as the inequality between generator output and turbine input persists, the system speed will continue to drop as shown on the frequency curve. The decrease in frequency makes a relatively small change in turbine output, but delivers a relatively large amount of kinetic energy, because kinetic energy varies as the square of the frequency. Within ordinary frequency variations water-wheel output varies about as the square root of the frequency, and steam-turbine output is nearly independent of frequency. Therefore, changes in system load are supplied largely by stored kinetic energy, unless and until some control device is applied to the turbine. The flow of energy in the transmission lines between the various generators and motors in the whole system is so nearly instantaneous that the kinetic energy of the whole system acts as one large fly-wheel. Thus, the rotating masses in generators, motors, fly-wheels, etc., all over the system slow down almost simultaneously when a load is added, until there is a balance between electrical output and mechanical input.

Frequency Change and Load Change

This slowing down would continue and the system would stall, if there were no control devices, if the consumer's load remained constant during a change in frequency, and if the turbine output remained constant

during a change in frequency. Actually the consumer's load decreases rapidly as the frequency decreases, tests on large systems having shown 2 percent to 12 percent drop in kw. for 1 percent drop in frequency. Voltage drops resulting from frequency changes are responsible for much of the load drop since large generators have magnetic time constants of several seconds, and high-speed automatic voltage regulators cannot increase excitation instantly to completely offset speed decrease.

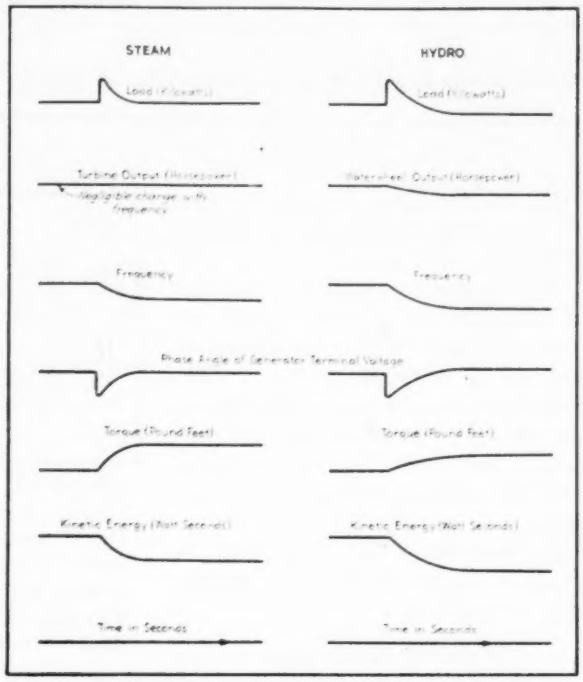
Power consumption of lighting and heating loads varies as power of the voltage, usually between 1.5 and 2.0. Such loads are otherwise independent of frequency. The power consumption of one type of motor load (such as sawmills) varies directly with the frequency. The power consumption of fan or centrifugal compressor load varies as the cube of the frequency. The average power consumption of all motor load is generally considered to vary about as the square of the frequency (neglecting voltage drop).

Combined effect of voltage and frequency drops on the total load on a large system varies considerably from one system to another and is largely beyond control. Nevertheless, a knowledge of its approximate value is very useful in controlling and correcting the change in frequency by means of compensating changes in generation. This decrease in load is shown by the sloping portions of the system load curve which have a shape similar to the frequency curve.

Measure of Stability

Difference between power output of the turbines and power input to the consumer's load is a measure of the stability of the uncontrolled system. If the power output of the turbine decreases 0 to 0.5 percent and the power input to the consumer's load decreases 3 to 6 percent for a 1 percent decrease in frequency, an average figure might be 4 percent excess of generation above load after a 1 percent drop in frequency. This is shown by the load and frequency curves for steam and hydro generators.

Since the steam-turbine output is largely independent of small frequency changes, the system load curve slowly returns to a value about equal to the initial value whereas the load for a hydro system returns to a value slightly lower than the initial value due to decreased output of the water-wheel at lower frequency.



EFFECT OF ABRUPT LOAD INCREASE on frequency, torque, phase angle, kinetic energy, and turbine or water-wheel output for an isolated system without governors or control devices. (Interactions between various elements have been simplified in order to emphasize major consequences of an initial load increase)

In either case the new load added to the systems is ultimately provided by slight reduction in load taken by other devices. Since this figure is positive and large, the system is self-regulating, without manual control, governor control, or electrical control. This is because the excess of generation over load in case of frequency drop tends to raise the frequency. That is, the output-frequency characteristics of power system generators and power system loads provide a fair margin of stability, especially for small changes (59 to 61 cycles). For large frequency decreases, the load is lost due to low voltage. For large frequency increases, turbine power output decreases, instability results.

Systems vary greatly in their flywheel effect, but most water-wheels have enough kinetic energy, if it could be utilized as the machines *slowed to a complete stop*, to carry full load for about three seconds with all water shut off. Steam turbines have enough kinetic energy to carry full load for three to eight seconds with all steam shut off. In addition, there is some kinetic energy in motors, synchronous condensers, and all types of rotating machinery in the power plants and on the customer's premises. In practice, a system would coast for a much longer time because loads would decrease rapidly with the speed decrease due partly to voltage decrease.

Unbalanced Condition

Change in system frequency due to unbalance between load and generation (without any help from the governor) may take a minute to approach its final value, because the rate of change tapers off as balance is approached. This frequency change is logarithmic, and approaches its final value very slowly, just like a heated object reaching its final temperature. About 95 percent of the change occurs within a time equal to 3.0 times the average inertia constant of the system. This means that a frequency change, due to load or generation change, unaided by any control device, will take at least 10 sec. before it is 95 percent completed. On steam systems with a large percentage of motor load, the time may be 20 to 60 sec. This time is largely independent of the total magnitude of the change, although the rate (in hundredths of a cycle per second per second) is about proportional to the total magnitude of the change.

So far, no mention has been made of manual control, or of electrical or mechanical devices, such as voltage regulators, governors, tie-line load controllers, etc., which can be used to control the output of the generators. Without such devices the ordinary system would be stable or self-regulating for small or moderate load changes. However, such a system would vary in speed over such a wide range that voltage and frequency would not be acceptable to consumers. Therefore, mechanical or electrical devices responsive to frequency, volts, or kilowatts, are utilized on all systems, large or small. Manual control supplements these devices.

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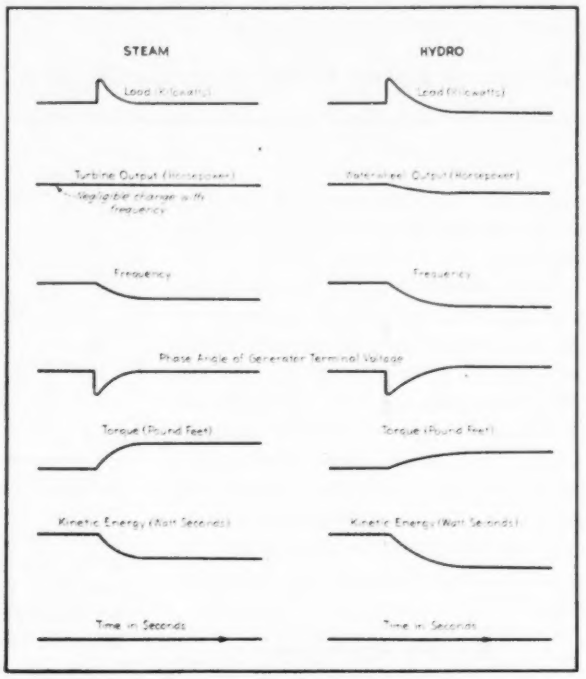

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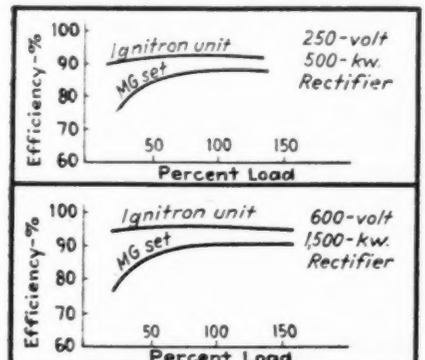
Rectifiers and Inverters Have Broad Application Field*

Authors weigh factors influencing selection of mercury vapor rectifiers over rotating equipment for power conversion—Examine use of mercury vapor inverters as frequency changers, for interconnecting a.c. power systems of different frequencies and for variable speed motor drive

*G. F. JONES and J. H. COX,** Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.*

THE MERCURY ARC power rectifier, a laboratory curiosity at the turn of the century, stands today a vigorous and vital factor in the conversion, interchange and control of large blocks of power. Early made in small sizes and in glass envelope form, the rectifier emerged from World War I with a metal tank but still in its multi-anode tank form. Not until the late 1930's was this displaced by the single-anode rectifier of the synchronously excited ignitron and continuously exicted excitron types familiar today.



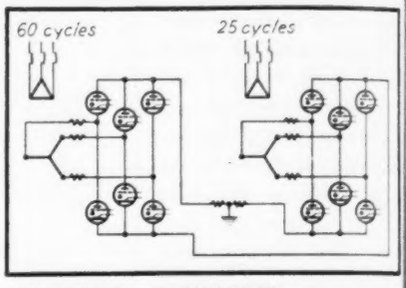
EFFICIENCY CURVES for 250, 600 and 3,000-volt mercury vapor rectifier units show increased efficiency advantage at higher voltages over rotating conversion equipments of same capacities

Even more recently, however, the development of phase control of mercury rectifiers has introduced inversion of power from d.c. to a.c. This has opened a wide new vista in the control of power. Today in laboratory and early application stages rectifiers and inverters, paired together as electronic frequency changers, foreshadow the possibility of practical high voltage d.c. transmission.

Rectifier Applications

But let us examine more closely the present status of the power rectifier and the inverter. Up to now, the ignitron rectifier has been used for high current applications from 125 to 900 volts d.c. and for low current uses up to 25,000 volts. With its nearly constant arc voltage drop, internal loss in the mercury arc rectifier is practically fixed for a given current and is influenced only silghtly by d.c. voltage. Its efficiency is, therefore, not so much in its favor at d.c. voltage less than 250. Also, since much of the auxiliary apparatus is the same for all sizes of tubes, it has an economic disadvantage at power below 75 kw.

Failure to apply the ignitron for straight power conversion at voltages above 1,500 d.c. is one of demand and not a limitation of design. Voltages of 3,000 volts d.c. are easily obtained and the ignitron will be supplied for 3,000-volt railway applications when demand is resumed.



SIMPLIFIED ELECTRONIC frequency changer circuit of the d.c. link type. Power from one system, converted to direct current in mercury rectifiers is inverted to the second system frequency by phase-controlled mercury vapor rectifiers or inverters

Mercury vapor rectifiers have superseded the rotating types of conversion equipment for very good reasons. At 250 volt d.c. and higher, the rectifier has a pronounced efficiency advantage, particularly in the lower load ranges. Typical efficiency curves are shown for conversion units at 250, 600 and 3,000 volts d.c. It will be noted that the efficiency advantage at the higher voltage figure is more pronounced which is due to the practically constant arc drop. Kilowatt loss is a function of this arc drop and the d.c. ampere output of the unit. The efficiency figures of the curves include the rectifier transformer losses as well as those of the rectifier including its auxiliaries.

Comparative Cost

At 250 volts d.c., the average initial purchase price of a rectifier is somewhat higher than the corresponding price of a rotating machine but at 600 volts d.c. and up, price of the rectifier

* Adapted from paper presented by the authors at recent National Electronics Conference in Chicago.

** Engineers in Industrial Division and Transportation Division, respectively.

is approximately equal to or less than that of a rotating machine. Installation costs of the rectifier on the other hand are considerably lower since rotating machines require special and costly foundations and large volumes of cooling air. Rectifiers require only a reasonably level support, strong enough to support the static weight. Since the rectifier is water cooled, substation building volume need be only sufficient for housing the apparatus without consideration for special ventilation. In some locations, air cleaning equipment is required for rotating machines. This represents additional installation as well as operating cost.

The d.c. voltage characteristic of a rectifier is determined almost entirely by the characteristics of the transformer which supplies it with power, assuming a constant, sinusoidal voltage supply to the transformer primary windings. For a normal transformer design, this results in approximately a 5 percent drop in voltage from light load to full load. This voltage characteristic is a straight line. This permits paralleling with other rectifiers and with rotating, shunt machines without special regulating devices. Moreover, the rectifier lends itself to d.c. voltage regulation by means of regulating devices in combination with phase control; an inherent part of all modern rectifiers. Any desired form of d.c. regulation may be secured by means of this equipment.

Lagging power factor and harmonics are the two features of superiority of the rotating machine over the rectifier.

Power Factor

Power factor of a rectifier is determined by the reactance of the rectifier transformer and of the a.c. supply system. It is also determined by the method of transformer winding connections which determines the mode of operation. For the average installation, the power factor will range between 92 and 95 percent. This power factor is lagging and is fixed by the design. If the d.c. voltage of a rectifier is reduced from normal by the use of phase control, the power factor is reduced in approximately the same percentage as the d.c. voltage is reduced.

A rectifier generates harmonics in both the a.c. supply system and in the d.c. system. These harmonics are a function of the transformer connections and the reactance of the apparatus and power circuits. If the d.c. voltage of the rectifier is controlled by phase control, the harmonics in both systems are increased in magnitude. However, these harmonics are of interest only in so far as they may give rise to a telephone interference problem or to heating of generators or machines connected to the same systems. For the average installation, the machine heating problem is of no consequence and is considered for very special applications only. Whether the harmonics give rise to a telephone interference problem will depend upon telephone plant construction and exposure between the power system and telephone lines. As a practical matter, with the usual types of installations, difficulty from harmonics as related to telephone interference has been encountered in only isolated cases and corrective measures have been nominal.

Due to limitations in vacuum technique, early metal tank rectifiers used continuously operating pumps to maintain the required vacuum. This technique has improved to an extent that allows metal rectifier tubes to be permanently sealed. At present, there are a great many sealed ignitron tubes in service with ratings up to 200 amp. average per tube.

The point in rating which divides sealed tube and pumped tube construction should be that at which there is an economic balance between the price and life of sealed construction and the price and and maintenance of vacuum pumping equipment.

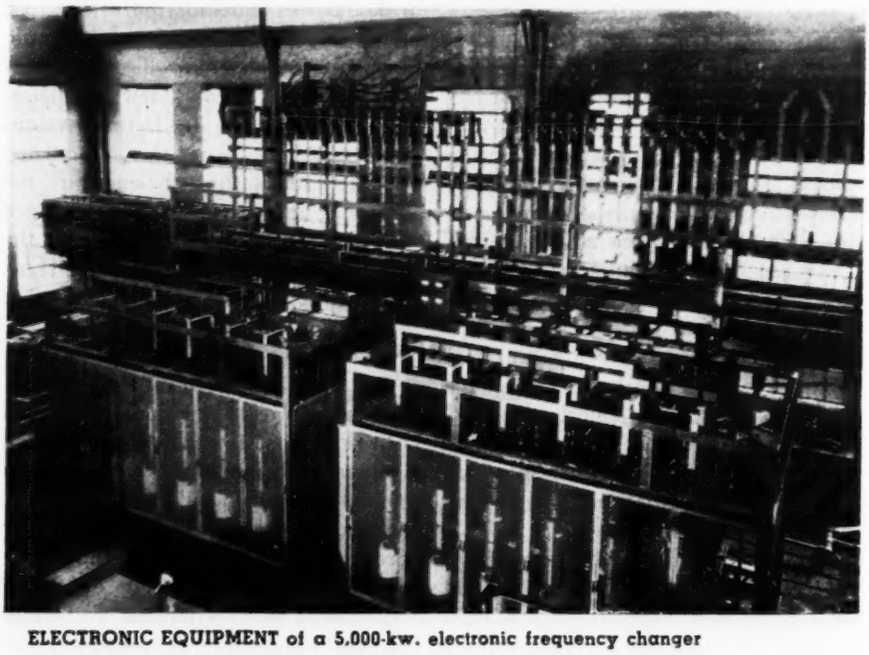
The ratings of the rectifier are really determined by amperes in a given voltage class. Up to 300 volts d.c., the kilowatt rating of the 250-volt rectifier may be increased in proportion to the increase in voltage above 250. In the 600-volt d.c. class, kilowatt ratings may be increased in proportion to the voltage increase up to 900 volts.

Rectifier units at 1,500 and 3,000 volts d.c. have been applied to date for heavy traction service and these units are available up to the largest required by the industry.

Special Rectifier Applications

Development of phase control of mercury vapor rectifiers, provided by grids in the continuously excited type and by the ignitors in the ignitron, has made it possible to invert power from d.c. to a.c. as well as convert from a.c. to d.c. This has opened up a wide field of applications where power can be controlled in large amounts, similar to the manner in which control is utilized in the communication field. In this category are: Regeneration for heavy traction systems, frequency changers, interconnecting a.c. power systems of different frequencies, high voltage d.c. transmission, and the broad field of variable speed motor drive.

For traction systems regenerative braking of trains operating over heavy grades, offers the advantages of power saving and reduced rolling stock



ELECTRONIC EQUIPMENT of a 5,000-kw. electronic frequency changer

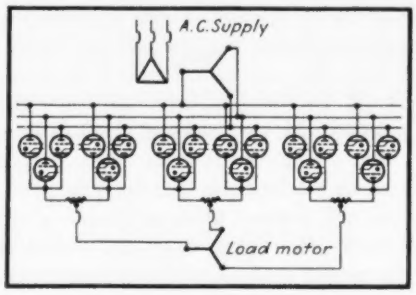
maintenance. The ignitron, with suitable controls, can be used to return regenerated d.c. power to the a.c. system. But since the mercury vapor rectifier is a one way device and it is not possible to reverse the polarity of the trolley, it is necessary either to reverse the polarity of the d.c. power circuits to the rectifier to secure inverted operation, or to have a second rectifier connected as an inverter. Both systems have been used. Where a separate rectifier is used, permanently connected for inverter operation, this can usually be of smaller capacity than the equipment connected for rectification.

Frequency Converters

Where there are two a.c. power systems of different and closely controlled frequencies, the most economical way of tying them together is through rotating frequency changers. However, if one or both of the power systems, which are to be tied together are of fluctuating frequency, some kind of a variable ratio tie must be used. The electronic frequency changer is ideal for this type of application since the tie between the two systems is a d.c. link which does not take into consideration the frequency of either system. An electronic frequency changer consists of a rectifier unit which converts a.c. power to d.c. and an inverter unit which inverts the d.c. to a.c. The amount of power interchanged between systems can be controlled in any manner desired. The control can take the form of constant power interchange or to transfer peak demand or a combination of the two.

The majority of installations will be between central station and privately owned power systems such as a steel mill having its own generating plant. Power house fuel is usually process gas, the supply of which varies with blast furnace activity. This gives rise to alternate cycles of excess and insufficient power. The most economical way of taking care of this condition is to provide a power line between the steel mill system and the public utility. The electronic frequency changer can be controlled to interchange power in either direction at will. Two installations of this kind have been made.

The most attractive feature of the electronic frequency changer is that it is completely variable ratio and its control is simple. Its efficiency is quite high, being approximately 94 percent. Its disadvantages are relatively high cost and relatively low power factor, that is, of the order of 80 percent. An inverter demands a definite amount of leading reactive kva. from the receiving system for its proper functioning. Both the rectifier and the inverter are harmonic generators. These harmonics appear on both systems, to a greater extent than is the case for a simple rectifier installation. As has been previously mentioned, these harmonics may give rise to a telephone interference problem.



VARIABLE FREQUENCY a.c. power is supplied directly to motor windings by the "cycloconverter" circuit above. Duplicate tube groups connected to each motor terminal provide alternating current. During periods of the motor power cycle when the voltage is opposed to current flow, the rectifier group carrying current operates inverted

D. C. Transmission

If the d.c. link between the rectifier and inverter of an electronic frequency changer is made long, we have a d.c. power transmission system. Of course, the adaption of an electronic frequency changer to d.c. transmission of power creates new problems, some of which are still in the development stage. For the frequency changer, only the efficiency of the terminal equipment is of importance and moderate d.c. voltages of the order of 25 kv. may be used. However, to make the d.c. transmission attractive, considerably higher voltages are necessary, since we are interested in the efficiency of line transmission as well as terminal equipment. In order to attain the necessary high voltage, tubes may be connected in cascade in considerable number. This adds complication and cost. At the present time, economic studies indicate that the cost of electronic equipment with switchgear and transmission line is such as to balance with a.c. transmission at distances of the order of 400 miles and with blocks of power of the order of 300,000 kw.

Adjustable Speed Motors

Electronic devices lend themselves to use in providing adjustable speed motor drives from alternating current power supply systems for a wide variety of applications. The Mot-o-trol is a simple form of such a drive. In this device, electronic tubes are used to supply variable d.c. voltages to d.c. motors to secure a wide speed range. Variable voltage is supplied to armature and field from independently controlled rectifiers, permitting speed changes by either field or armature control. It does not eliminate the commutator of the conventional d.c. motor. The electronic units replace the earlier motor generator set and the principle advantage gained is extremely flexible speed control.

With the availability of higher power tubes, the advantages obtained by electronic control of motor drives can be extended to the highest power requirements of industry. The versatility and flexibility of electronic circuits permit a wide range in types of circuits possible. In the more attractive types, electronic devices are used in a manner to eliminate commutators and variable frequency a.c. power is supplied directly to the machine windings. Most of these circuits involve inverted operation of tubes.

Cycloconverter

One of the circuits which has been developed is known as the cycloconverter. Basic principles of this circuit are shown. By suitable control of the rectifier groups, alternating pulses are supplied to the machine windings at the desired frequency. Duplicate groups of tubes, inversely connected, are connected to each motor terminal, to provide alternating currents. During those periods of the motor power cycle when the voltage is opposed to current flow the rectifier group carrying the current must operate inverted.

Another scheme which is attractive where only small speed ranges are required consists of electronic equipment which supplies controlled frequency to the rotor of an induction type machine. In this case, the electronic equipment supplies only the slip frequency power and, therefore, need be only a fraction of the power rating of the motor.

Sells Tomorrow's Load Today

"Plan and Save" program initiated and forwarded by utility enlists active cooperation of over 150 local business concerns—Emphasis is on kitchen modernization—Interest in model contest

ANNA BELLE GOLDSWORTHY, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

A POST-WAR PLAN with an active present as well as a future is the Hudson Valley Home Improvement Plan, launched by the Central Hudson Gas & Electric Corp. of Poughkeepsie, N. Y. Throughout the region served, all allied trades, businesses and professions interested in joining with the utility for home betterment are organized to help residents definitely plan and save now for the improvements they want when the war's progress allows industry to produce household equipment and supplies again. Home modernization will be a vital factor in the reconversion of industry and business, including the replacement of wornout appliances and equipment, the promotion of new types of equipment, and the furnishing of homes for many couples just starting housekeeping. Coordinating the activities of allied interests, this plan will create essential employment for military and war industry personnel returning to peacetime pursuits. Opportunities will be opened in many lines as an increasing demand is developed for services, equipment and material required in home improvement. This plan in no way interferes with the war effort by tying up material but serves to blueprint home requirements for material when it is no longer needed for military purposes. People are urged to buy as many War Bonds as possible, thus instead of spending for luxuries now, to put the extra money into savings for home betterment.

Cooperative Program

"Plan and save now for better living," is the slogan of the cooperative program which was originated by Harris E. Dexter, vice-president in charge of commercial relations of the Central Hudson company. The Hudson Valley Home Improvement Plan has received an enthusiastic welcome among the general public and the group of more than 150 firms working with the utility. This group includes banks, appliance distributors and dealers, electrical contractors, plumbers, architects, general contractors, builders, lumber companies, painters, interior decorators, and

IDENTIFYING SYMBOL used in advertising and on mail by participants

home furniture and furnishing merchants. They assist residents in making definite plans for postwar home improvements, estimating the approximate cost and working out a plan of regular savings for it. Nine commercial banks are establishing objective savings accounts, like Christmas Clubs, in which depositors can save systematically for their home improvements, and they will also provide financing arrangements; other institutions such as savings banks and building and loan associations will loan money for this purpose. An outstanding example of bank cooperation is the opening of 100 home improvement accounts in two weeks' time by a Poughkeepsie bank. In addition to organizing the plan and assisting with publicity for all participants, Central Hudson is putting on its own kitchen modernization program and contest for schools and community groups.

Advantages for Utility

That is the overall view of the home improvement plan. Before going into a little detail as to its operation, let's consider the advantages coming to the utility. Besides the fact of there being practically no new appliances to sell, utilities are, of course, restricted by wartime regulations from developing further residential use of service. This organized activity, providing mental relaxation by giving customers something to think about besides the war, is starting them on definite plans for their homes, so that they'll be ready for immediate purchase and installation when appliances and home wiring improvements are available. This will speed the return to normal operation and add permanent load to the company's lines. The company will again help dealers promote appliances; the dealers will make all the sales in accordance with the company's long established cooperative merchandising plan. The increased business for the company will provide employment in all departments for employees now on leave of absence, when they return from the armed forces, war industries and civilian government posts. The plan is developing increased goodwill among the customers, general public, schools, community groups and all participating firms, plus an awakened consciousness of what the company's service means to the home. The increased business accruing to allied firms will mean prosperity and larger payrolls going into circulation locally. Home modernization will in-

crease property values and help attract new residents and business to communities—which will be reflected in company business. Whatever benefits the region will, in turn, benefit the utility company.

ASSEMBLING a prize contest entry

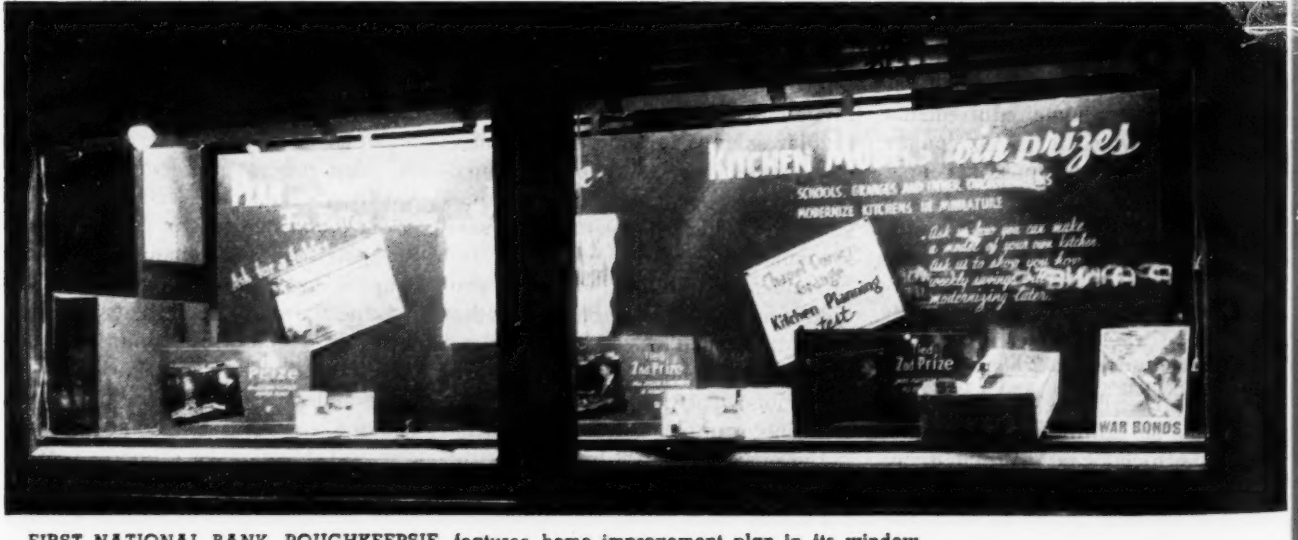
Meetings and the Press

Holding organization meetings for all interested allied firms, Central Hudson started the Hudson Valley Home Improvement Plan rolling at the beginning of October, 1944. While it has been put into action simultaneously throughout the region in some aspects, the coordinated local publicity introducing the idea is being rotated, covering each section through its chief community. The first public announcement was made in Kingston on October 10, the next was made in Poughkeepsie and Beacon on November 28, the date scheduled for Newburgh was January 23, and Catskill's turn was scheduled for February. A special home improvement issue of the local evening paper is published with the assistance of the utility and the whole-hearted cooperation of the press which publishes illustrated feature articles on postwar home modernization, written by the utility's staff and other representatives of cooperating groups. The participating firms, using an identifying symbol, place advertisements in the paper explaining their part in the new plan. In Kingston, Poughkeepsie and Newburgh, where there are local radio stations, a home modernization broadcast is part of the day's publicity, with civic officials and representatives of allied firms, radio station and newspaper speaking on the program. Short daily announcements on the plan are then broadcast for several months.

HOME SERVICE DIRECTOR stages a kitchen planning demonstration

Other Publicity

Other publicity features continually keep the idea before the public. Window display signs furnished participants by the utility announce, "Headquarters for the Hudson Valley Home Improvement Plan." The Central Hudson continues to publish newspaper ads about the plan, and the allied firms tie in with this advertising—all carrying the identifying symbol. Window and floor displays are carried by the company's district offices and by cooperating firms, including some banks. The banks have their own folder, prepared with the utility's assistance, which they distribute. It is imprinted with the individual bank's name and explains the objective savings accounts. The symbol of the plan, in the form of stickers, is used on mail by participating firms and by the Central Hudson, which has also embodied it into the postage permit imprint.



FIRST NATIONAL BANK, POUGHKEEPSIE, features home improvement plan in its window

Throughout its territory the utility is conducting its own kitchen modernization program with a prize kitchen model contest. This is offered to high and junior high school classes, especially the home economics groups, and to various community organizations, including women's clubs, granges, church societies, 4-H Clubs, Girl Scout troops, Farm and Home Bureaus, and may be secured by request at any of the company's district offices. The program, omitting the prize contest, is given at service clubs to increase public knowledge of the program's scope and availability. All arrangements for the program and for assisting participating firms are in charge of J. Ellis Briggs, special representative for the company, while the demonstration and prize contest are in charge of Rita Abbruzzese, the home service director, and are conducted by members of the home service staff. Up to the end of 1944 there had been 43 of these meetings with a total attendance of 3,562. By May 15 the company plans to cover every high and junior high school and all women's organizations in meeting its objective of 150 demonstrations and 3,000 kitchen models entered in the contests.

Requests for Programs

This kitchen modernization program is proving most popular with both student and adult groups. The requests for the program come in by phone, mail and personal calls at company offices and are also developed by a group of customer contact personnel in the course of their regular duties. Highlights of the dramatic platform demonstration are the transformation of an old-fashioned kitchen into a completely equipped one of postwar design, using a good-sized model with walls which reverse to make the quick change, and an animated kitchen floor plan with electric lights flashing on and off to represent steps taken in an inefficient kitchen and the same room modernized.

Model Contest

The contest, offering a variety of prizes from $25 War Bonds to War Savings Stamps, electric appliances and certificates of merit, centers about the preparation of a miniature three-dimensional kitchen model, based on the individual's own kitchen, and is accompanied by a brief essay. The complete model is constructed from accurately scaled cut-outs—floor plan, side walls, appliances, equipment and furniture—contained in the kitchen planning manual, published by Central Hudson and furnished free to contestants. The plan book, illustrated with diagrams and photographs, is also available, priced at $1, at the company's district offices and at some other firms desiring to distribute it. The price is refunded to customers who complete and submit models at any district office. All models, including prize winners, are returned to the individuals to keep as a practical guide to their families' postwar kitchen modernization. In the meantime the company keeps a record of all completed models as the basis for a mailing list for future home improvement announcements.

The originality and detail shown in the contest models tell an eloquent story of the genuine interest taken. The whole family, as well as the contestant, gets in on the fun of seeing their dream kitchens take form and color. While more entries are naturally received from the distaff side, the masculine element is often in the front lines. In fact in one group of seven school winners, three were boys, one of whom took the first award. The prize-winning models and photographs of the top contestants are displayed in local show windows and news releases with photos announcing the winners are published in local papers.

They're definitely planning and saving *now* for better living in the mid-Hudson Valley. When victory's needs have been met by American industry, they'll be ready to improve their homes immediately, creating essential employment for the boys and girls returning to them after serving Uncle Sam and manning our war industries.

FOR BETTER LIVING IN YOUR POST-WAR HOME . . .

AUTOMATIC LAUNDRY	✓
REFRIGERATOR	✓
COMPLETE NEW KITCHEN	✓
TELEVISION	✓
F.M. RADIO	✓
FLUORESCENT LIGHTING	✓
FROZEN FOOD STORAGE	✓
COOKING EQUIPMENT	✓
WATER HEATING EQUIPMENT	✓
AIR CONDITIONING	✓

When you check over the things you want to buy after the war, you may think you won't be able to afford all of the things you'd like to have.

Why not start a savings account—NOW—so that you will have the necessary money...or a good down payment? Open a **HUDSON VALLEY HOME IMPROVEMENT PLAN** account. Save as little as $1.00 a week, or as much more as you want, for your future home modernization. It's surprising how small regular savings soon build up into a goodly amount!

At any of the following banks ask for full information regarding the **HUDSON VALLEY HOME IMPROVEMENT PLAN:**

Join the HUDSON VALLEY HOME IMPROVEMENT PLAN

National Ulster County Bank, Kingston
Rondout National Bank, Kingston
First National Bank, Poughkeepsie
Poughkeepsie Trust Company
Fishkill National Bank, Beacon
Matteawan National Bank, Beacon
Highland-Quassaick National Bank, Newburgh
Columbus Trust Company, Newburgh
National Bank of Newburgh

CENTRAL HUDSON
GAS & ELECTRIC CORPORATION
"Serving the Central Hudson Valley"

Hear **NELSON EDDY**
"The ELECTRIC HOUR"
every Sunday afternoon at 4:30 WABC

COOPERATION WITH BANKS promotes saving for better homes

Transformer and Allied Equipment Failures

THE TABULATION of data on transformer and associated equipment failures covering the 1943 lightning season which were collected from member companies by the Transmission and Distribution Committee of the Pennsylvania Electric Association is shown below. These companies serve approximately 45,000 square miles and have a total single-phase transformer capacity amounting to 2,376,450 kva.

Failures were catalogued by use of the following definitions:

1. Transformer failure. Failure is one which results in the loss of service to a customer or group of customers, during or within 48 hours after a storm, or any transformer failure subsequent to a storm, the cause of failure being directly attributed to lightning. Where both the winding and leads are damaged in a trans-

	General Data																		Transformer										
	Distribution Characteristics						Transformers in Service												Total			Winding Failures per 100 Transformers							
							Kva. Size Groupings					Type of Protection Groupings																	
Company	100 Circuit Miles	100 Wire Miles	Area Served—Square Miles	Line Voltage—Kv.	Connection Type	Minimum Fuse Size—Amperes	5 Kva. & Under	7.5 to 15 Kva.	20 Kva. & Over	Total Single Phase Units	Average Kva. per Transformer	With External L. A. & Interconnected Neutral	With External L. A. & Non Interconnected Neutral	Total with External Lightning Arrester	Without Lightning Protection	Self Protected	Completely Internally Protected	No. of Failures	Rate per 100 Transformers	Total No. Winding Failures	Total	With External L. A. & Interconnected Neutral	With External L. A. & Non Interconnected Neutral	Total with External Lightning Arrester	Without Lightning Protection	Self Protected	Completely Internally Protected	Total No. of Bushing & Lead Failures
1	129.8	301.0	9000	2.3 4.0 4.8 6.9	Δ Y Δ Δ	10	19880	8383	2368	30631	8.9	25497	2491	27988	N	N	2643	207	0.68	151	0.49	NR	NR	0.54			O	34
2	30.0		817	2.3 4.0	Δ Y	7	7467	7557	7357	22381	19.3	9820	11650	21470	N	N	911	109	0.49	63	0.28	0.40	0.21	0.29			O	46
3	110.32	411.72	9000	2.3 4.0 6.9 4.0 4.6	Δ Y Δ Δ Δ	5	30850	11100	6519	48469	8.8	33301	14402	47703	N	13	753	243	0.50	209	0.43	NR	NR	0.42		O	0.93	33
4	69.87	150.92	2953	2.3 6.6 4.6	Δ Δ Δ	5	10618	2932	2057	15607	10.5	10214	5002	15216	24	489	39	93	0.59	68	0.43	0.51	0.32	0.45	O	O	O	24
5	6.44		416.57	2.4 4.16	Y Y	10	1784	2193	1146	5123	15.5	5112	O	5112	O	2	9	4	0.08	3	0.06	0.06		0.06		O	O	1
6	42.94	113.51	7845	2.4 4.0 4.8 6.6 8.32 11.0	Δ Y Δ Δ Y Y	5	11355	6041	2187	19583	9.4	9123	7685	16808	N	355	2422	171	0.87	164	0.84	0.18	1.88	0.95		O	0.17	7
7	13.49	36.4	5000	2.4 4.6 6.9 11.0 13.8	Δ Δ Δ Y Δ	1	2711	1426	843	4980	15.0	3635	1317	4952	O	28	O	19	0.38	16	0.32	0.36	0.23	0.32		O		3
9	7.03	26.96	414	2.3 4.6	Δ Δ	5	2021	1069	584	3674	12.6	NR	NR	3448	O	O	226	23	0.63	20	0.54			0.58			O	3
10	11.7	30.52	129.7	2.3 4.1	L Y	50	409	1366	6610	8385	34.4	6700	O	6700	1641	39	5	24	0.29	17	0.20	0.18		0.18	0.30	O	O	7
10-A	47.59	102.83	1417.7	2.3 4.1 2.3	L Y Δ	15	10237	7465	3216	20918	11.3	15929	N	15929	N	1547	3442	105	0.50	75	0.36	0.40		0.40		0.45	0.15	29
11	31.9	77.82	1389.7	4.8 12.0	Y Δ	3	8906	1859	698	11493	6.6	1750	2868	4618	N	4827	2048	75	0.65	NR								NR
13	4.16	9.54	315.92	2.3 4.6 4.0	Δ Δ Y	5	1261	477	498	2236	12.7	1596	100	1696	O	508	32	5	0.22	3	0.13	NR	NR	0.12		O	3.13	2
14	17.77	39.43	4653	2.3 6.9 4.6 11.0	Δ Δ Δ Y	5	4990	842	378	6210	5.8	2617	1471	4088	2119	O	3	63	1.01	NR							O	NR
16	2.7	6.5	91	2.3 4.16	Δ Y	5	728	233	33	994	5.4	392	384	776	120	3	95	O										
17	7.43	21.16	1020			10	1903	268	96	2267	5.6	2067	O	2067	O	1	199	12	0.53	NR								NR
19	2.89	6.45	219	4.0 7.2	Y Δ	5	941	109	26	1076	4.6	358	55	413	O	247	416	14	1.30	12	1.12	2.51	1.82	2.42		0.81	O	2
20	1.98	4.53	96.6	2.4	Δ	2	775	194	34	1003	5.5	436	398	834	O	O	169	7	0.70	NR								NR
21	1.5	2.76	61	2.3 6.9	Δ Δ	15	226	63	46	335	9.3	191	O	191	O	42	102	4	1.19	3	0.90	1.57		1.57		O	O	0
Total							117062	53607	34696	205365	11.6	128738	47823	180699	3904	8099	13514	1178	0.57	894	0.44							195

former, the failure is catalogued under "Winding Failures."

2. Fuse and fuse boxes. The functioning of fuse boxes or destruction of fuse boxes, either of which results in loss of service, are classified as fuse and fuse box failures under "Fuse Box Failures" and not as transformer failures.

3. Transformers provided with external lightning protection are those in which the protective equipment is a separate and independent piece of protective apparatus mounted externally to the transformer and between the high-voltage circuit and high-voltage bushing of the transformer.

4. Transformers without lightning protection are those for which no provisions have been made, other than the inherent characteristics of the transformers, to protect them from lightning failure.

5. Self-protected transformers are those in which the protective equipment is contained within or constructed as an integral part of the transformer unit.

6. Complete internally protected transformers are those equipped with protective device, sectionalizing equipment, and secondary breaker constructed as an integral part of the transformer unit.

In the table N = negligible, NR = no report and O = zero.

| Failures | | |

Editorials

S. B. WILLIAMS, *Editor*

Change in Viewpoint Needed in Rural Service

ABOUT HALF THE FARMS of the nation now have electric service connections. This is a great achievement, reflecting credit on all participants in the effort, although some critics deprecate it as not enough to show for 25 years of work. Considering that the aim was wrong, the result has been magnificent.

Rural electrification is not an end to be worked for. It is only a means to an end, a means that must be joined with many others if the end is to be achieved. The end is two-fold. It is to raise rural up to the level of urban living in terms of freedom from household drudgery, and to improve and increase farm production in the same way industrial production has been improved and increased.

Because the means was confused with the end, because rural electrification was regarded simply as the job of making minimum electric service available to the rural population, the real purpose has suffered. We say "minimum" electric service because that is actually what it has turned out to be very generally. Hundreds of thousands of rural homes and farmsteads have been wired inadequately; conductors of insufficient capacity and transformers too small for potential loads characterize mile upon mile of rural distribution lines. Too many thousands of farmers, with and without electric service, look upon it as a luxury to be afforded; too few thousands know it as a productive tool they can't afford to be without. For too long electrification has been regarded as a boon to be brought to the rural population; the time is ripe, and over ripe, for it to be appreciated for what it is, a necessary element in modern rural living and in modern agricultural production.

Some evidences of such a change in attitude towards rural electrification are now appearing. The Monongahela West Penn Public Service Co. sends a farm supervisor to college for a short course in the design and arrangement of farmstead structures. When he returns his job will not be to sell electric service to farm customers; it will be to help them make their plants efficient production units. Naturally, electricity will be a necessary agent in that efficient production. For years Westinghouse has been sponsoring "rural electrification" contests among farm boys and girls. These have now been broadened out to become "better farm and home methods" contests. Naturally, better methods will use electricity in most instances. Another indicator of the different viewpoint is the foreseen large post-war use of arc welding on farms. The condition will not be one of electric service making arc welding possible on farms but of arc welding on farms requiring electric service.

All concerned with electric service in rural areas—utilities, cooperatives, manufacturers and, most importantly, the farmers themselves—must shift their viewpoints, must see their problems in different lights, must revise their philosophies and their practices. There must come new thinking on cost, performance and efficiency of farm electrical devices and equipments, on adequacy of farm installations and system facilities to which they are connected, on rates as elements of cost in productive operations instead of as prices paid for luxury or, at best, convenience.

It will take time to get out of the rut of old ways of thought in regard to rural electrification. But the rut must be left for the wider road if electric service is to work improvement in agricultural production comparable to what it has accomplished in industrial.

Incautious Statements on Brownout Effectiveness

SOME NEWSPAPER STATEMENTS attributed to utility people belittling the effectiveness of the brownout as a fuel saver seem to have irked some people in Washington who have the responsibility for making fuel conservation work. Right now the public is willing to believe that every new restriction on civilian activities grows out of a "hair shirt" philosophy. For that reason any statement by individuals, whom the public are willing to believe before they would believe some bureaucrat in Washington, should be carefully weighed and not made until all the facts are known and not even then if the effect will be to bring lack of compliance.

It is true that the two or three million tons of coal yearly that it is estimated will be saved by the brownout is but a very small part of the total of more than six hundred million tons used each year. It is a much bigger percentage, however, of the estimated deficit of between thirty-five and forty million tons.

On the other hand, if the saving was even less and did no more than call attention in a very forceful way to the seriousness of the fuel situation and the necessity of preventing anything from disturbing fuel production at this time, it still would be worthwhile.

The people who are administering the brownout have all along shown their desire to work with the power industry and to be as understanding of local situations as possible. It is hoped that people in the industry will be careful to do nothing to bring about any public distrust of this order so long as the fuel situation is so critical.

Aerial and Buried Cable

CONSIDERABLE INTEREST is being manifested in possible future use of both self-supporting and plowed-in cable as alternatives to less sightly, less rugged or more costly construction. But coupled with the interest there is a reticence that needs to be dissolved before the hoped-for installations are likely to be made.

It is squarely up to cable manufacturers whether these newer types of cable go places or whether they stay in the present nibbling stage. Take self-supporting cable. Not enough is known by enough engineers about the means for splicing it or dead-ending it. Even the salesmen who sell it seem not, it is reported, to know what to recommend although there are such means that are giving satisfaction. Certainly the advocates of cables with a functionally inbuilt messenger can hardly expect prospective users to devise their own contraptions indefinitely, nor even do their own hunting for hardware, and splicing methods.

What is needed is the development of a complete system based on this relatively recent form of aerial cable. Hardly any of the open-wire hardware is adaptable. There must be a whole integrated family of connectors, taps and terminators. The family might even include a bracket that would release the cable undamaged if a tree should fall across it.

Much the same can be said of buried cable. One wonders why the development that started a decade or so ago stopped so abruptly. Whatever the reason, is there not enough more known about protective coatings to warrant a revival of the programs? Wherever the trend has to be towards underground in less dense areas, buried cable could well be given consideration. It will not unless there is assurance that fault-locating methods (even cable locating methods), a durable covering, a repair technique, a junction and terminating procedure are well assured in advance.

In both instances the techniques of installation, extension and maintenance are definitely different from those of open-wire construction with which so many are familiar, or even of duct-cable. Converts from both groups will not be won until they see their way through all the ramifications of stringing, laying, tapping, splicing, terminating, searching and trouble-shooting.

Utility Properties Need Relighting

THE MOTHER of all utility loads is lighting. It started that way and, while sometimes overshadowed by heavy industrial demands such as war loads, it is still the basic business. Many utility heads are recognizing this in their post-war plans. They see the need for making an all-out effort on lighting. That is, they see the need for revamping the lighting of everyone's premises but their own.

One has but to make a trip throughout the country to realize how backward our utilities are in modernizing the lighting of their own offices, showrooms and plants. One wonders how many utilities have made a lighting survey of their properties? One company we know has just started on such a program and that company has been one of the leaders in the promotion of better lighting.

After the war there will be more varied lighting tools available than ever before. How better can these be shown to customers than in the utilities' own premises?

One gets the impression in visiting utility offices, and particularly showrooms, that the lighting is of the same vintage as the building, that little if anything has been done to improve it. One also gets the impression of studied economy in foot-candles. In fact in not a few instances the cost of the installation has been cited as a reason for not making an improvement. Does it cost the customer any less?

There is a job of relighting America ready to start just as soon as equipments are available. Let's number the utilities among our early prospects.

Consulting the Metermen

METER SUPERINTENDENTS AND ENGINEERS perform their defined day-to-day tasks within a comparatively narrow band of the whole spectrum of utility activities. That should facilitate classifying their departmental activities but, strangely enough, the place assignment of the meter department on the organization chart varies more from company to company than almost any other department. This fact testifies not only to the diversity of fringe interests of the meter heads but because of the diversity suggests that they should be called into more of the conferences that establish policies.

Meter practice verges into distribution techniques, into customer service philosophy, into rate details, into billing and accounting, into the legal procedures aimed at diversion, into company and customer substation design, into telemetering, into off-peak controls, into interchange contracts and, last but not least, into day-by-day relations with the public.

The complaint is an old one that rate structures and service contracts are drawn up and signed without even asking the meter engineer if the stipulated quantities can be metered. Fortunately there is less of this than there used to be and some of the improvement is attributable to the fact that the metering experts have been consulted before details were committed.

Who should own the substation serving an industrial customer is a matter of negotiation and adjustment. But who should provide and maintain the housing for the metering equipment brings in more questions of company, public and regulatory policies. The meter department should not be ignored when such decisions are made. Its advice should be helpful in passing on the matter of adopting compensating metering on the system itself to avert primary metering. Certainly it should be heard on programs of water-heating load building and any off-peak promotion.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Too Much Hurry to Repeal War Time

THE DESIRE OF FARMERS to get their operations back on standard time and the desire of state and federal legislators to combine a "lesson" for the bureaucrats with a popular political move has raised again what is getting to be an annual campaign for the abolition of war time.

Last year, the drive centered in the House Interstate Commerce Committee, a subcommittee of which was in a fair way to report favorably a bill which would have junked war time summarily on the eve of the invasion of Europe when it took no mastermind to guess that the maximum attention to business by the home front was necessary. Edward Falck, who had just taken over the directorship of the Office of War Utilities, put out that fire by demonstrating to the subcommittee just what repeal would mean in the way of harassing war production.

State Legislatures, Now

This year, despite clamorings of the two leaders of last year's Congressional move for repeal, the drive seems to be centered in various state legislatures. In some cases, it takes the form of straight repeal. In others, the dodge is to decree that the state concerned shall be considered to be in the time zone next west. This, it is argued, eliminates the inconvenience of war time while, by avoiding outright repeal, it allows the state government to assert that it is going along with a repressive war measure.

Once again OWU is carrying the ball in opposition to defections from war time, although it may muster more imposing support from other federal agencies this time, since other agencies, notably the Solid Fuels Administration for War, have appreciably more at stake now than they did on the last go-round. When war time was installed three years back, it was a capacity measure pure and simple. Last year, it was still a capacity measure, although fuel savings were more important than before. This year, capacity is as important as anything else, but so are the fuel savings, particularly coal savings.

There are other organizations in Washington which have an interest in maintaining war time on at least as broad a scale as that on which it is now practiced. Both the Navy and the Maritime Commission have an interest, for the situation which held last year holds today. The generating units most needed in the event that war time is repealed at all widely—smaller size steam turbine for non-interconnected municipals and other small systems—are the machines necessary to power merchant and smaller naval craft. Maybe the farmers who want "God's time" back will give up the labor necessary to make the additional units, although this is unlikely on the basis of the protests from farm states against renewed drafting of farm boys for combat.

Cancel Brownout Saving

The projected desertion from war time should interest even War Mobilizer Byrnes, for if it were to spread appreciably, the coal savings of his eminently successful brownout would be sadly chewed up. In that event, the country would have the inconvenience of the brownout without its fuel savings.

The effect of desertions from war time is cumulative. Having seen one state junk it without an immediate subsequent curtailment of electric service, the next state figures it, too, can drop out of parade successfully. It would not take much of this to nullify an interconnection which might be able to carry one deserter.

Perhaps, in the event of widespread evasion of war time, Mr. Byrnes might feel called upon to "request" it on the same basis that he "requested" an end to horse racing and a midnight curfew. The fat would then be in the fire, if past history is to be credited. Early in the war, the President asked Congress to enact a statutory limitation on incomes—ceiling $25,000. Congress refused. The President then instituted it by executive order. Not too long thereafter, Congress specifically voted the limitation out the window. Today, the limitation exists for practical purposes, under the tax schedules which Congress itself wrote. The whole thing, while it failed to lose the war, contributed nothing to national unity. A similar dispute over war time would add no more.

An interesting speculation which arises from the present tussle over war time concerns the extent to which OWU can afford to accept whatever defections it is unable to prevent.

Tightened Controls

There are systems in which repeal of war time would impair reserves to such a degree that OWU, being charged with the responsibility of power supply, conceivably might be forced—and the word is forced—to exercise the strictest control over additional loads. This is hardly revolutionary, for it was done under Order L-46, only recently revoked, in northwestern New York State early in the war when capacity was so tight as to require the allocation of reserves kw. by kw.

Such control probably could most easily be exercised by inserting in Order U-1 a paragraph declaring that orders supplementary to U-1, insofar as they allow construction of new extensions without specific OWU approval, shall not be applicable in areas where wartime is not observed. Perhaps it would require such a paragraph in each supplementary order.

While such a move would not automatically bar all new extensions, it would control them by assuring OWU of an opportunity to make certain that capacity was available for the proposed load increase. As long as OWU accepts the responsibility of making proper capacity available—and furnishing sufficient fuel to operate it—not even the farmer begging for electric service could complain against the exercise of the powers necessary to fulfill the responsibility.

NEWS OF THE WEEK

Chinese Hydro Program Described by J.L. Savage

U.S. Reclamation Bureau Dam Designer Tells of Yangtze Gorge Project with a 750-Ft. Dam and 10,560,000-Kw. Capacity—Project on Tributary Would Have 800-Ft. Dam—Irrigation and Navigation Also Involved

A vast hydroelectric power program for China, the key project of which would be a 750-ft. dam in the lower Yangtze Gorge where 96 generators of 110,000 kw. would be installed in two dozen 50-ft. tunnels to give a total project capacity of 10,560,000 kw. with an annual output of 71,300,000,000 kw.-hrs., was outlined this week by John L. Savage, U. S. Reclamation Bureau dam designer on loan to the State Department.

Savage returned to the United States recently after 13 months in India and China where he surveyed numerous power, irrigation and flood control projects. In addition to the Yangtze Gorge project, other Chinese projects reported upon by Savage call for an additional 2,500,000 kw. on tributaries of the Yangtze, one of which would have an installed capacity of 1,200,000 kw., and another of which would entail the highest dam in the world, about 800 ft. Several other Yangtze tributaries remain to be investigated, Savage said, as well as the huge Yellow River, which Chiang Kai-shek has asked Savage to investigate next year.

Most of these dams would also entail irrigation. The Yangtze Gorge Project alone would provide irrigation water for 10,000,000 acres and a channel and locks allowing 10,000-ton ocean-going vessels to negotiate the 650 miles from the China coast to Chungking.

Interior Department officials who sponsored Savage's conference barred questions relative to financing of the Chinese projects. The Washington Daily News reported a Chinese news service broadcast asserting that funds for the project would be borrowed from the United States and repaid within 15 years from profits of a $400,000,000 fertilizer plant it said was included in the Yangtze development. The broadcast said Chinese irrigation under the program would total 60,000,000 acres.

Savage, who has been the hydroelectric power consultant for Donald M. Nelson's economic mission to China, estimated cost of the Yangtze Gorge project at $89 per kilowatt, which would bring the total cost, not including any transmission facilities, to $939,840,000. He said the flow of the Yangtze is "very much more uniform" than that of the Columbia River which is highly regarded in this country for uniform flow the year around. To achieve the 71,300,000,000-kw.-hr. output envisioned by Savage, the Yangtze Gorge units would have to be operating at capacity almost 80 percent of the time the year round. Maximum possible output per year from the 10,560,000 kw. would be 92,505,600,000 kw.-hrs.

The fabulous Yangtze Gorge project described by Savage was, he said, the best of five possible sites he had located by means of aerial maps. Only one of the five sites could he visit, Savage said, since the others near Ichang, were located in Jap-held territory.

To build this dam, the construction of twenty 50-ft. tunnels for diversion of the river would be required. An additional four tunnels of the same size would be constructed, with four 110,000-kw. machines set in each tunnel at right angles to the river. The part of each tunnel beyond the turbines would serve as tail water tunnels. The generating plant would be located inside the mountain forming part of the gorge. The dam would require about 15,000,000 cu. yd. of concrete, and could be completed with 20 percent of the generating capacity installed in six to seven years. The remainder, Savage said, could be installed in three to four years more, although he said he saw no need for such hasty development. He said 140,000,000 people live within transmission distance of the Yangtze project.

Savage added that he knew of no other power site in the world whose possibilities were so great. The $89 per kilowatt Savage estimated as the cost he described as "conservative," but he said it was based on pre-war U. S. prices. The dam would provide 50,000,000-acre-ft. of storage, and back up a lake 250 miles long.

Other projects on which he reported Savage described as follows:

Ma Pien Ho River, a Yangtze tributary, a low dam with a 320,000-kw. power plant.

Ta Tu Ho River, another Yangtze tributary, would have a 500-ft. dam with three 30-ft. diversion tunnels running 7 kilometers upstream to the Ma Pien Ho Reservoir with a 1,200,000-kw. plant at the end of the tunnels. The plant would be 40 kilometers upstream from the Ma Pien Ho plant.

World's Highest Dam Planned

Upper Ching Ming River, a third Yangtze tributary, would have what "looks like the highest dam in the world," about 800 ft. high, with power capacity of 260,000 kw. Downstream therefrom would be a low dam with a "relatively small power plant." This would protect and enlarge the 1,400-Year old Quanhsien Irrigation project whose headworks are washed out each year by floods. Some Chinese oppose this dam as unneeded since the project has operated successfully for 1,400 years without it.

Two other projects with "small" power plants would be located at Changshow, about 80 miles from Chungking, and near Kumming.

Savage said the Chinese Natural Resources Commission had inquired about the Yangtze Gorge project some years

ago in this country where it was considered "a joke". He ascribed U. S. engineering ridicule of the project to the fact that never had any project in this country been undertaken on so large a river. At one point in his investigation of the gorge, interior officials brought out, Savage and his party surveyed a site which was between Jap and Chinese battle lines near Ichang. A captured Jap aerial map, corroborated by U. S. aerial maps of the area, served as the basis for his report on the gorge.

Savage, who introduced the artificial method of cooling huge concrete masses in Boulder Dam, which he designed, was awarded the John Fritz medal this year by the American Society of Civil Engineers. In 1934, he was awarded an honorary doctorate of science by the University of Wisconson, from which he was graduated in 1903. In 1937, he was awarded the gold medal for outstanding engineering service by the Colorado Engineering Council. He has been with the Bureau of Reclamation since shortly after his graduation from Wisconsin, except for eight years as a consulting engineer. He is a member of the ASCE, The American Society for Testing Materials, The Colorado Society of Engineers, The American Concrete Institute, Institution of Civil Engineers of Great Britain, Tau Beta Pi, Sigma Xi and Chi Epsilon.

Named chief designing engineer of the Reclamation Bureau in 1924, he designed, in addition to Boulder Dam, Grand Coulee, Shasta; Norris and Wheeler Dams of the TVA System; Friant Dam of the Central Valley Project; Madden Dam at the Panama Canal; the Marshall Ford Dam in Texas; Imperial Dam on the California-Arizona Border; Parker Dam on the Colorado River and American Falls Dam in Idaho.

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Nature Lovers to Oppose Potomac River Program

Nature lovers, sportsmen and the National Capitol Park and Planning Commission will oppose the proposed $235,000,000 flood control and power program projected for the Potomac River basin by the Army Engineers when public hearings open April 3.

Calling for construction of 14 dams and completion of another in 20 years, the program, according to its opponents, would destroy beautiful sections of the Potomac and its watershed, including the old Chesapeake and Ohio canal.

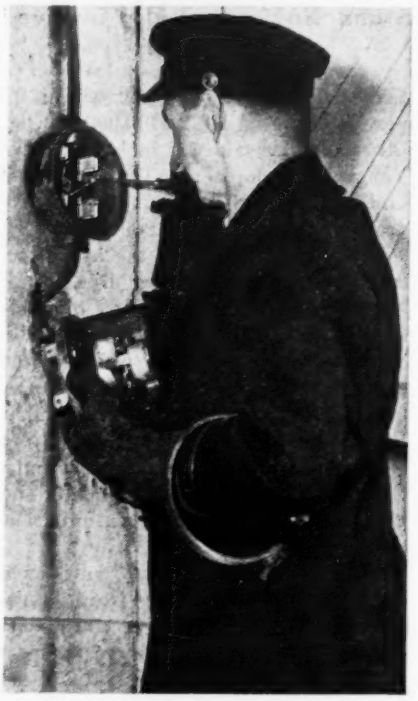
The program will be reviewed by the Board of Engineers for Rivers and Harbors, and, if approved by this agency, presented to Congress for immediate consideration.

Utility Precautions Cut Flood Damage

Companies Along Ohio Suffer Little Loss—Service to Customers Maintained Despite Obstacles

Experience gained in the 1937 flood and precautions taken since then paid dividends during the past two weeks to utility companies along the flood-swollen Ohio and its tributaries. On the alert as the river began to rise, utilities following prearranged plans closed flood gates, anchored equipment in storage yards, rushed coal in by rail, and moved motors and meters on the premises of their customers. By use of jumpers, current was made available to customers as usual.

These precautions saved equipment, much of which is replaceable only with difficulty, worth thousands of dollars; hours of time, especially important in these days of manpower shortage; and enabled rapid restoration of service as the floods subsided.



ONE OF 3,600 METERS—Serviceman of the Duquesne Light Co. replaces one of the 3,600 single-phase meters which were removed when floods threatened the Carnegie district of Pittsburgh. Service was maintained by "jumpering." High-water mark can be seen about two feet below meter

Little damage was reported by companies to power stations, substations, or transmission lines. Loss of load in most cases was negligible though Duquesne Light Co. reported a 6 percent drop in output during the flood crest. Industrial production along the river was hampered because coal could not be transported by river barges during height of the flood and because workers in many cases could not reach the plants as transportation was lacking.

For the second time in less than a decade, the Tygart Dam, exclusively for flood control, proved its value. Monongahela West Penn Public Service Co. reported that its plant at Rivesville, near Fairmont, W. Va., would have been out of service and electric power throughout the territory would have been at a crippling low level if the dam, which held 174 feet of water back of its 232-foot height, had not been there.

U. S. Engineers in the Pittsburgh district figure that it saved the "Golden Triangle" district the equivalent of a million dollars an hour for each foot of Monongahela water held from the potential crest at the junction with the Allegheny.

Duquesne Light reported moving 3,600 single-phase and 300 power-type meters, but 300 single-phase meters were affected by a flash flood in the Chartiers Creek area.

This flash flood also caused an accumulation of two feet of water in the basement of the Canonsburg Substation of the West Penn Power Co. and a foot of water on the floor of the Wylie Avenue Substation at Washington, Pa.

R. E. Burger Plant of the Ohio Public Service Co. (See Page 78) operated without difficulty as the coal storage pile was more than ten feet above water. Coal was also available by rail.

Cincinnati Gas & Electric Co. and its affiliate, Union Light, Heat & Power Co. directly across the river reported no interruptions to service. Following the 1937 flood, Cincinnati G, & E. floodproofed its West End and Columbia generating stations 7.5 feet higher than the highw-water mark of 1937.

Working in row boats, line crews cut in a 66-kv. line to the pumps at Millcreek Barrier Dam which had been operating on power from a temporary line. The pumps quickly lowered the creek level five feet below that of the Ohio River and kept the war industries of the Millcreek Valley on the job.

Kentucky Utilities Co. reported uninterrupted service though in its office at Augusta, Ky., water was a foot deep on the floor.

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Post-War Plan Revealed

A post-war program calling for the construction of 1,250 miles of rural lines at a cost of approximately $1,500,000 has been announced by the Potomac Edison Co.

Ohio Valley Authority Bill Omits Power Provisions

Measure Patterned after TVA Legislation Concerns only Flood Control and Irrigation—Bill to Add Cumberland River and Tributaries to TVA Domain Introduced—Reference of MVA Debated in Senate

An Ohio Valley Authority Bill, patterned largely after TVA and MVA legislation but omitting completely the power provisions of each has been introduced by Rep. George H. Bender, Ohio Republican, who told the House that "I think the power feature should be eliminated from the consideration of this proposition and that we should consider it from the standpoint of flood control only."

The bill provides for development of family-type farms with no federal irrigation water going to holdings whose irrigable land is in excess of 160-acres, allows the President to transfer existing dams and other facilities to the new authority and establishes an advisory board similar to that proposed in the Missouri Valley Authority Bill recently introduced by Sen. James E. Murray, Montana Democrat.

Elsewhere on the River Valley Authority front, Rep. J. Percy Priest, Tennessee Democrat, has introduced a bill adding the Cumberland River and its tributaries to the domain of TVA. The bill, unnoticed in earlier sessions, was introduced after the President requested that Congress take such action.

Murray Asks Rereference

In the Senate, debate on the reference of Murray's MVA bill flared as Murray insisted that the Committee on Agriculture and Forestry, which handled the TVA Act 12 years ago, be given his bill, which originally was referred to the Commerce Committee. Sen. Josiah Bailey, North Carolina Democrat and Commerce Committee chairman, defended the original reference and offered as a substitute for Murray's resolution sending the bill to the Agriculture Committee, another resolution authorizing the Commerce Committee to study those portions of the bill dealing with flood control and navigation, the Irrigation and Reclamation Committee to study those portions dealing with irrigation and reclamation and the Agriculture and Forestry Committee to consider the agricultural features, which Murray said predominated. The references would run consecutively rather than concurrently, and each committee would be required to report within 60 days. Action on the whole question was stymied temporarily by a parliamentary technicality.

The annual vendetta of Sen. Kenneth McKellar, Tennessee Democrat, against TVA opened again this week as the Independent Offices Bill was reported by McKellar's Senate Appropriations Committee. The committee amended the bill to provide TVA an additional $7,000,000 of which $4,000,000 would be used to carry on construction of South Holston and Wautauga Dams as soon as the War Production Board lifts an existing stop order on their construction.

McKellar then brought forth the perennial anti-TVA amendment which would appropriate for the agency the sum it needs to carry on operations between next July 1 and June 30, 1946, and which would require TVA to turn all its revenues into the Treasury. Normally, TVA uses its receipts and asks for whatever other appropriations are necessary for capital improvements. The South Holston and Wautauga amendment was approved early this week, but the amendments on appropriations and disposition of revenues were passed over temporarily.

It was not felt that the House would accept the anti-TVA amendments even if they pass the Senate since the House fights all attempts in appropriation bills.

In reporting the Independent Offices Bill, the Senate Committee added $8,000 to the Federal Power Commission's fund for printing and binding and reduced its appropriation for salaries and expenses by $331,534, leaving it at $1,818,466. The Securities and Exchange Commission's appropriation was slashed $234,500 leaving the total at $3,900,000. Both amendments went over temporarily when the bill reached the Senate floor.

The Senate still dallied with the nomination of Aubrey Williams for the administratorship of the Rural Electrification Administration early this week. Only action taken in the matter during the week ended Tuesday was the formal reporting of the nomination with an adverse recommendation.

The delay was believed to have helped rather than hindered Williams' cause, and prospects for his confirmation were considered a little brighter early this week than they were a week earlier. Sen. Theodore Bilbo arose on the floor to reiterate his opposition after a group known as "Friends of Aubrey Williams" inserted an advertisement in a Washington newspaper calling attention to a statement made by Bilbo to a constituent. The sentence, which Bilbo insisted was torn from its context and did not fairly represent what he said, was:

"We do not want this negro-lover on this job."

Bilbo claimed the phrase "negro-lover" was a colloquialism in the South referring to a white man who "crossed the color line," and defended the letter as proper.

The matter was of consequence in the whole Williams fight since the advertisement brought the race matter into the picture and the backbone of Williams' opposition lies in Republican senators who can ill afford to take a stand beside Bilbo on the matter so long as the race question is or believed to be an issue.

UTILITY EXECUTIVE BECOMES WINDOW WASHER—Henry W. Price, district manager of the Potomac Edison Co. at Cumberland, Md., washes the windows of a local hardware store. Mr. Price's services for one day were secured by a group of friends who purchased $2,000 in war bonds

Acquisitive Powers of P.U.D.'s Restricted

Oregon Passes Chessman Bill to Keep P.U.D.'s from Entering Area unless Customers Consent

A major victory in limiting acquisitive power of Oregon's P.U.D.'s was chalked up early this week when the state legislature passed to Governor Earl Snell for signature the Chessman Bill which prevents P.U.D.'s from serving outside their own territory without consent of new customers.

Emerging from the House without the emasculating amendments, bitterly fought for by public power advocates, which would have stripped the measure of its primary purposes, the bill was passed by the Senate with two innocuous amendments attached by a vote of 29 to 1. The House had passed the bill, originating in the Senate, 38 to 19.

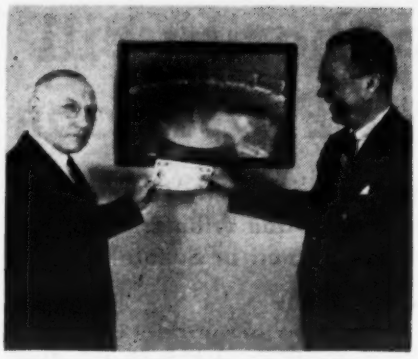
Containing an emergency clause to prevent its being delayed by referendum election, the act hampers the invasion of municipalities by P.U.D.'s by empowering cities within proposed P.U.D. boundaries to determine by ballot if they are to be engulfed by the district's boundaries, regardless of the majority vote in the rest of the proposed district.

Will End "Hood River" Scares

Expedited through the Legislature, the bill tightens the state's utility district code to prevent a recurrence of the Hood River scare of 1943 when the rural P.U.D. threatened to gain control of all major electric systems serving Portland and adjacent municipalities through a $175,000,000 bond issue.

Temporarily blocking action on the bill in the House were attemps to attach an amendment which would have eliminated "home rule" protection for the cities and deprived them of the right to determine by vote if they wished to be included in proposed districts. It would have been possible for any P.U.D. in the state to acquire private property by an affirmative vote of the entire district. Spearheading the fight against the amendment was Portland City Commissioner Dorothy McCullough Lee of the Department of Public Utilities.

One of the provisions of the bill is that a P.U.D. may extend its services to a "fringe" immediately adjacent to its boundaries, but the amount of territory to be served will be determined by the state hydroelectric commission after a public hearing. Incorporated cities, however, cannot be included in this fringe area without the approval of city voters.



AID TO ACCOUNTANTS.—V. R. Baukat, left, assistant engineer, New England Power Service Co., Boston, receives a $25 U. S. War Bond from president and chief engineer Edwin A. Dow, for suggestion that accountants' code book pages be provided with schematic diagrams of identified apparatus, wiring, etc., to better visualize and clarify understanding of plant equipment and layouts throughout the New England Power System.

Electric Service Dispute in Warren Up to Courts

Ohio courts have before them two suits affecting electric service in Warren, Ohio.

In the one suit, Ohio Public Service Co. seeks to restrain Mayor Robert H. Roberts and Service-Safety Director James R. Craig from signing a contract for an electric survey with Burns and McDonnell, Kansas City, and to restrain City Auditor B. M. Hillyer from certifying that $13,500 is available to pay for the survey.

The company contends that since the money was appropriated last year but not used, the survey fund no longer exists and also attacks validity of the legislation passed by Council authorizing the survey contract.

In the second, a mandamus suit, Ohio Public Service seeks to compel Elizabeth Jones, clerk of council, and George G. Johnson, president of council, to authenticate and publish an ordinance read for the third time at the meeting of council on February 5, with reference to a five-year contract with the company.

The ordinance would give the city free street lighting, which costs $40,000 a year, and would continue present rates for domestic and commercial users.

Controversy over the ordinance results from the refusal of one councilman to vote. Under the law, an ordinance must be approved by a majority of six of the ten members of council. The vote was 5 to 4 in favor of the ordinance, and the courts will have to decide whether the refusal of the councilman to vote aligns him with the proponents of the measure or with the opposition.

Opposition to War Time Spreads to Minnesota

Paul Valle Appeals to House to Defeat Measure Moving State from Central Time Zone

The fight on War Time spread this week to Minnesota where Deputy Director Paul B. Valle of the Office of War Utilities' power division appeared before the House of Representatives to ask defeat of a bill which would remove Minnesota from the Central War Time zone and put it in the Mountain War Time Zone. The bill had already passed the Minnesota Senate.

In Wisconsin, where OWU Director Edward Falck testified on a similar bill a week earlier, the measure, passed by the House, was to be voted upon by the Senate late this week. It was believed that the measure would not become law in Wisconsin.

Rumblings of a similar move to evade War Time in Nebraska had reached OWU at Washington.

Valle told the Minnesota legislators that a defection in that state would "impose a critical additional load on the electric generating facilities in your state . . . which are already overburdened," and that it would substantially increase coal consumption in Minnesota.

Peak Demand Would Rise

He said the bill, if it became law, would add 30,000 kw. to the system peak in the state if first-class cities are not exempted and would add 21,000 kw. to the system peak if first-class cities were exempted.

"This will create a serious operational hazard," Valle said, "particularly in the cases of a number of the independent municipal systems where the generating capacity is already strained to the limit and in which localities the curtailment of the use of electric power for stores, offices and less essential industries may be required if the proposed bill is adopted. The same is true of a power company serving the southern part of your state."

Pointing out the material and manpower savings which resulted from War Time, Valle emphasized that the present capacity situation in the state was not a result of poor power planning but that it was a studied policy aimed at keeping power installations at a minimum to free materials and manpower for military production.

Elimination of War Time in Minnesota, Valle said, would cost 30,000 tons of bituminous coal annually if first-class cities were not exempted and 20,000 tons annually if they were exempted.

Legislation in Washington Strengthens State's P.U.D.'s

Likely Passage of Four Bills Sent to Governor Will Give Business-Managed Companies Severe Blow—Public Power Groups Get Sweeping Authority to Act without Restraint of Voters or State Commission

Public-operated utilities which, for the past two decades, have shown steady progress as outlets for the vast supply of Pacific Northwest electrical energy, emerged victorious and with still greater strength from the Washington state legislature last week.

During the final crush of business, four bills, all directly or indirectly concerned with Public Utility Districts, were hammered through the House and Senate, some of them even after the clocks had been stopped.

Headed for Gov. Mon C. Wallgren's desk for signature, there appeared little doubt that they would become laws.

While private utilities, which have long feuded with P.U.D.'s in the state, overtly regarded most of the legislation as innocuous and declined to acknowledge a serious setback in their protracted fight, there were factors that could not be completeely ignored.

Private Utilities at Disadvantage

In H.B. 405, private utilities found themselves forced into the position of "placing a price on their own heads." This they acknowledged, for the legislation provided:

"In condemnation proceedings conducted by a Public Utility District for acquisition of electrical distribution properties, the P.U.D. may cause to be filed with the Department of Public Service a petition requesting a rate to be filed for the sale of wholesale power to the District. Thereupon, the Department shall order that a rate be filed forthwith for the sale."

Spokesmen for the private untilities protested that this would force them to place a price on power without knowing the quantity to be sold. The quantity factor, they argued, is of vital importance in establishing a price schedule.

Described by private ownership groups as a virtual strangle hold, the P.U.D.'s won a still more forceful advantage in another provision of the same bill which admittedly places private utilities in the position of figuratively feeding a mouth that bites them. The provision: "upon reasonable notice any such public service corporation which owns or operates electrical distribution properties being condemned or purchased, or which owns or operates transmission facilities within a reasonable distance of such distribution properties and engages in selling power, shall furnish wholesale power to any P.U.D. owning or operating electrical distribution properties."

In H.B. 342, P.U.D. commissioners found themselves vested with sweeping authority and freed of P.U.D. boundary limitations. The act empowers them to sell, convey or lease all or any part of a P.U.D.'s works, plants, systems, to another Public Utility District, city, town or public corporation without the necessity of submitting the question of sale to the voters of their district.

While private utilities minimized the import of the act, in essence, it contained many of the provisions of a power referendum bitterly opposed by private enterprise and defeated by a 7 to 5 vote in the November elections. (ELECTRICAL WORLD, November 11, 1944, Page 107). It grants P.U.D.'s the power to purchase electric current, engage in power distribution and operate facilities for generating power within or without their district limits.

Also headed for the statute books is a bill exempting P.U.D.'s from regulations relating to transfer of franchises, properties and facilities relating to public service companies. Private utilities, although outwardly apathetic toward the measure, acknowledge that it enables P.U.D.'s to bypass the State Department of Public Service.

At the same time, some of the state's private utilities found themselves facing the necessity of operating through two state authorities—a Department of Transportation and a Department of Public Service—which another bill created as branches of the Department of Public Service.

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SEC Will Appeal Decision on Standard Gas Co. Plan

A decision of the United States District Court at Wilmington, Del., rejecting the reorganization plan of Standard Gas & Electric Co. as not being "fair and equitable" will be appealed by the Securities and Exchange Commission. George C. Mathews, vice-president of Standard, has also announced that his company will join in the appeal.

The commission said a quick decision will be sought, as the holding of the District Court that note holders claims may be satisfied only in cash is of importance in the enforcement of the Holding Company Act, and because there are several other plans pending before SEC containing provisions similar to that involved in the Standard Gas case.

SEC on February 23, approved two plans leading to the dissolution of Standard Power & Light Corp., parent company of Standard Gas, on condition that the District Court approve the Standard Gas reorganization plan (ELECTRICAL WORLD, March 3, Page 98).

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Monongahela Sends Man to Study Farm Structures

Convinced that better farm structures —houses, barns, implement sheds, chicken houses, and the like—must play a more important part in the over-all farm economy of the future, the Monongahela System has sent one of its key agricultural men from Fairmont (W. Va.) headquarters to the University of Illinois for a six-month special housing course.

James L. Copeman, who has been on Monongahela West Penn Public Service agricultural staff as a field counselor, rural load builder, and in other better farming capacities, will study and gather practical information which Monongahela will pass on gratis to farmers.

The company has completed surveys on 5,000 miles of new rural line construction and has acquired rights-of-way for more than half this total preparatory to launching construction when materials are available. A definite program will treble this 5,000-mile figure in the three years following the war and will boost the company's over-all rural service total approximately 400 percent.

Charles H. Leatham, operating vice-president, said:

"We feel that better farm buildings must give foundation to any program for agricultural improvement in our territory, and we want to be prepared to give sound counsel and advice to farmers who want better structures. That's why Copeman has been detached to study at Urbana."

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Rate Revision Postponed

The Illinois Commerce Commission has suspended until May 13, the effective date of proposed rates scheduled by the South Beloit Water, Gas & Electric Co. for electric service in South Beloit and Rockton.

Transfer of Federal Agencies Not Likely

Budget Bureau Planners Have Suggested Moving FPC, SEC, FTC, ICC to Commerce Department

Prospects that the Federal Power Commission, the Securities and Exchange Commission, the Federal Trade Commission and the Interstate Commerce Commission will be transferred to the Commerce Department and removed from their present status as independent agencies was considered remote this week although such a proposal has been made by Budget Bureau planners.

It was learned from a reliable source that disclosure of the plan was made without knowledge of Budget Director Harold Smith.

The President, who could make the transfer under the Second War Powers Act, told a press conference merely that he had not considered the matter since his embarkation for the Yalta conference.

The move was seen by some Washington political observers as a means of augmenting the powers of Commerce Secretary Henry Wallace, who lost control of the Federal Loan agency, formerly under the Commerce Department, when Congress recently passed the George bill reconstituting the Loan Agency with independent status.

Transfer Would Mean Fight

Principal reason advanced for the belief that no such transfer will take place is a familiar one—that the President will hesitate to incur the excellent possibilities for a bitter fight with Congress which are inherent in the proposal at a time when he will have the ticklish problem of maneuvering the treaties resulting from Bretton Woods and Dumbarton Oaks through the Senate.

It is widely believed in Washington that any such transfer would meet with considerable opposition in Congress, particularly as far as it might concern the Interstate Commerce Commission. One commission spokesman said there is no doubt but what all affected agencies would forget their normal differences to band together wholeheartedly in opposition to such a transfer.

The President's War Powers authority to make such transfers without specific Congressional authorization is good for the duration and six months, and excepts only the General Accounting Office. It is believed that any such transfer made under the War Powers Act would have to be specifically approved to continue beyond the expiration date of the present authority. However, it is felt that the chances of obtaining such approval would only be enhanced by several years of consolidation and operation under the Commerce Department.

Only federal regulatory agency which would not be under Commerce if the proposed transfer were to become a fact would be the Federal Communications Commission, since the Civil Aeronautics Administration and the Civil Aeronautics Board are already under Commerce.

It was learned that the proposed transfer, which has been under study in the Budget Bureau's Administrative Management section for months, at one time contemplated the establishment of a new Cabinet post under which all regulatory agencies would be grouped.

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Supreme Court Upholds SEC in Subsidiary Ruling

The Supreme Court, by splitting its vote four to four, upheld the Securities and Exchange Commission this week in an order terming the Pacific Gas & Electric Co., a subsidiary of the North American Co.

Mr. Justice Douglas, former head of SEC who disqualified himself, took no part in the vote. Under Supreme Court rules, a tie vote affirms the judgment on appeal. The SEC's order had been upheld by a lower court and came before the Supreme Court on appeal by P. G. & E.

Counsel for P. G. & E. had argued that even though North American, at the time SEC's order was issued, held P. G. & E. stock in excess of the 10 percent minimum allowed by the Holding Company Act, P. G. & E. was not in fact dominated by North American in its operations and policies and that it should not be held to be a subsidiary of North American. It was argued further that by next January 1, North American's holdings of P. G. & E. stock will have been reduced below the 10 percent minimum.

The California State Railroad Commission, as soon as the decision was announced, ordered the west coast utility to open its recently announced $80,000,000 refunding plan to competitive bidding. A request for competitive bidding had been made by Halsey Stuart & Co., investment brokers of Chicago.

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Appliances Repaired Free

Eastern Light & Power Co. and Dominion Utilities Co. have been repairing small electric appliances without charge except for any parts replaced.

Pacific Gas & Electric Co. Workers Propose Strike

Strike proceedings against the Pacific Gas & Electric Co. were instituted by AFL electrical workers in eleven of the utility's divisions outside the San Francisco bay area early in March.

Individual employees of the 3,450 covered by International Brotherhood of Electrical Workers collective bargaining agreements reportedly set in motion provisions of the Smith Connally Act by notifying the Secretary of Labor of their intent to strike at the end of 30 days. Union officials, however, claimed no responsibility for the action.

Cause of the threatened work stoppage was laid to unrest among I.B.E.W. workers created by asserted Regional War Labor Board delays in settling an intra-plant and inter-plant wage differential dispute with the company certified last fall. Employees have requested elimination of wage "inequalities and inequities" and charge the P.G.&E. with employing stalling tactics.

Regional WLB spokesmen attributed delays to a change of issues by the union and failure by them to meet dates set for filing of briefs. Stating that any strike action by I.B.E.W. members is unwarranted, Regional Chairman Thomas Fair Neblett said the case would go to the bottom of the docket if a strike were held.

Divisions of the P.G.&E. where strike votes were held are headquarters in the major central and northern California towns of Fresno, Stockton, Sacramento, Salinas, Auburn, Marysville, Chico, Red Bluff and Eureka. Included are the company's General Construction department and Natural Gas division.

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BPA Hires 3 Engineers to Aid Load Building

To aid in planning an elaborate load-building program promoting post-war use of Columbia River power, three engineering consultants were added recently to the staff of Ivan Bloch, chief of the Bonneville Power Administration's industrial and resources development division.

They are O. C. Falkovitch, formerly with the Tennessee Valley Authority, who will specialize in home heating and agricultural and urban uses of electricity; G. V. Palmrose, chemical engineer recently associated with Weyerhaeuser Timber Co. and Dow Chemical, who will specialize in the field of chemistry; and W. W. Schultz, formerly with Lithaloys Corp., New York, and the Office of Price Administration, who will specialize in development of the metallurgical industries.

Minority Board Member Attacks New Jersey Rates

Electric rates of the Public Service Electric & Gas Co. are declared "outrageously high" in a minority report presented to Governor Walter E. Edge by Crawford Jamieson, member of the New Jersey Board of Public Utility Commissioners. Jamieson made the charge in a dissent to the recent annual report of his two colleagues, Joseph E. Conlon, board president, and John E. Boswell.

Rates of the Jersey Central Power & Light Co. also should be reduced, said Jamieson.

By agreement between Public Service and the board electric charges of the company were cut an aggregate of $2,500,000 for the last half of 1944 and in future years by approximately $5,300,000.

"As a matter of fact," said Jamieson, "the $2,500,000 reductions to consumers in 1944 did not reduce the gross revenue by even that amount, as anticipated at the time of the settlement on July 1. The gross revenue of the company for 1944, on the contrary, was increased by $1,000,000."

In view of revenues not anticipated at the time of the settlement, Jamieson asserted, gross revenue of the company for the year was $9,973,000 in excess of a generous base and 6.4 percent return.

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Springfield Utility Gets P.S.C. Edict for Refund

A refund of $70,000 to electric and gas customers of the Springfield Gas & Electric Co. has been ordered by the Missouri Public Service Commission which has also promised quick action on Springfield's plea for authority to dissolve the company under a municipal ownership plan.

The refund will amount to $25,000 monthly for electric customers and $3,000 monthly for gas users in the period between January 1 and March 15.

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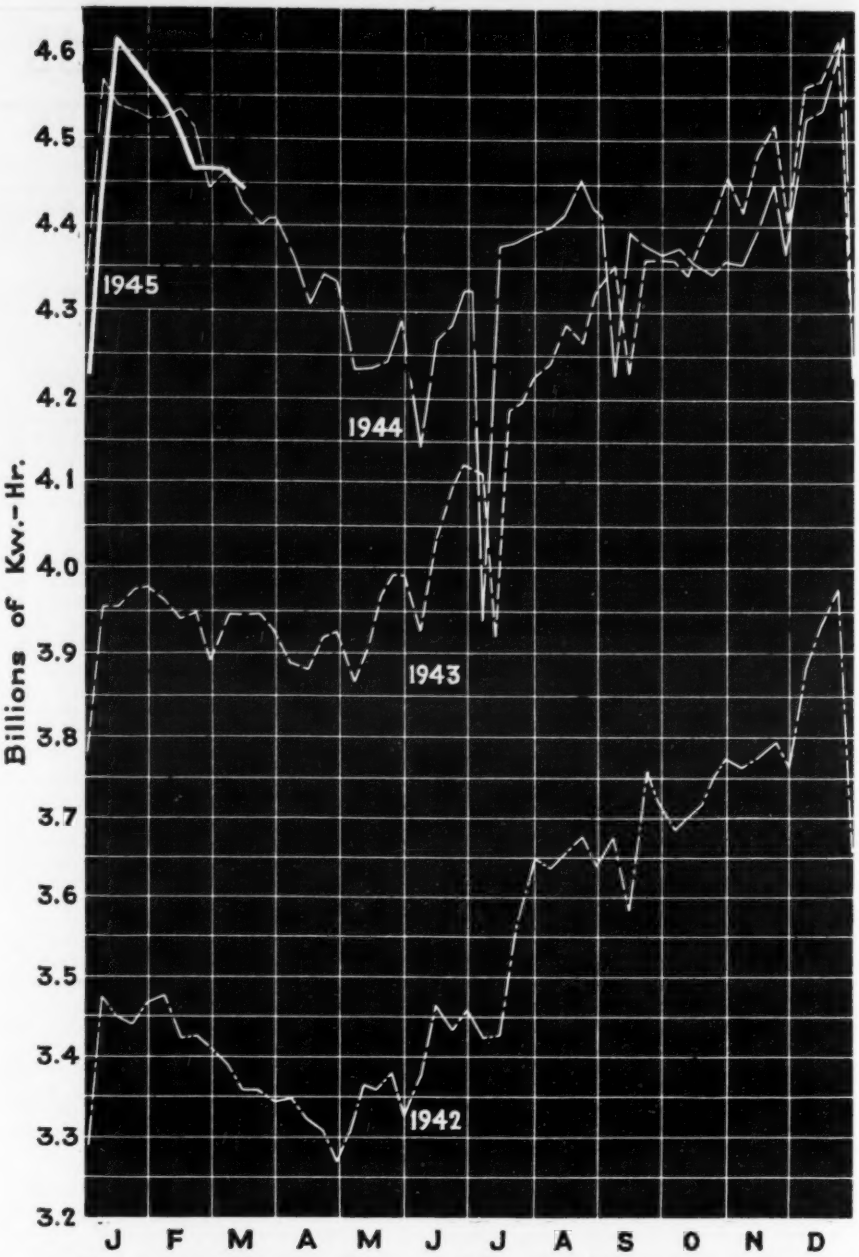
Energy Production Drops

Electric energy produced for public use in December, 1944, totaled 19,532,484,000 kw.-hr., a decrease of 2.2 percent when compared with December, 1943, according to a report issued by the Federal Power Commission. Average daily production of electric energy for public use in December was 690,194,000 kw.-hr., an increase of 2.7 percent, when compared with average daily production during the previous month.



Output Curve Again Moves Downward

The electric output curve moved downward again during the week ended March 10, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,446,136,000 kw.-hr., compared with 4,472,110,000 kw.-hr. during the preceding week. During the week ended March 11, 1944, the amount of energy distributed amounted to 4,425,630,000 kw.-hr., this year's figure representing an increase of 0.5 percent.

Four of the seven major geographic regions reported losses for the week ended March 10, 1945, as compared with the corresponding week of 1944, all four, however, showing smaller losses than those reported for the preceding week ending March 3.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Mar. 10	4,446	Mar. 11	4,426	Mar. 23	3,945
Mar. 3	4,472	Mar. 4	4,465	Mar. 6	3,947
Feb. 24	4,474	Feb. 26	4,445	Feb. 27	3,893
Feb. 17	4,472	Feb. 19	4,512	Feb. 20	3,949
Feb. 10	4,505	Feb. 12	4,533	Feb. 13	3,940
Feb. 3	4,539	Feb. 5	4,524	Feb. 6	3,960
Jan. 27	4,577	Jan. 29	4,524	Jan. 30	3,977
Jan. 20	4,588	Jan. 22	4,532	Jan. 23	3,974
Jan. 13	4,614	Jan. 15	4,539	Jan. 16	3,952
Jan. 6	4,427	Jan. 8	4,568	Jan. 9	3,953
1944		1943		1942	
Dec. 30	4,226	Jan. 1	4,337*	Jan. 2	3,780†
Dec. 23	4,617	Dec. 25	4,296	Dec. 26	3,656

* 1944 † 1943

Percent Change from Previous Year

	Week Ending		
	Mar. 10	Mar. 3	Feb. 24
New England	— 0.5	— 1.1	+ 0.9
Mid Atlantic	— 2.8	— 3.4	— 1.9
Central Industrial	+ 1.7	+ 2.8	+ 3.5
West Central	+ 7.3	+ 9.1	+ 8.8
Southern States	+ 6.3	+ 6.5	+ 6.9
Rocky Mountain	— 5.6	— 8.7	— 9.8
Pacific Coast	— 2.1	— 5.2	— 6.2
Total United States	+ 0.5	+ 0.2	+ 0.7

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

HAS RELEASED its jurisdiction over the accounting entries proposed to be made in connection with the retirement and issuance of securities under the reorganization plan of Laclede Gas Light Co. and over the proposed sale by the Ogden Corp. of the new common stock of Laclede Gas issuable to it under the plan. In this connection the commission clarified its order of May 27 1944, approving the plan to provide expressly that the application by Laclede Gas of $2,200,000 of the proceeds of the sale of electric properties operated by Laclede Power & Light Co. to Union Electric Co. of Missouri, to the retirement of certain of its bonds "is necessary and appropriate to effectuate the provisions of Section 11 (b) of the holding company act. This clarification was requested by the company in order to take advantage of substantial tax savings.

EXTENDED FOR a period of six months, dating from January 7, 1945, the time within which Cities Service Power & Light Co. is required to dispose of its indirect interest in the water business of Marion-Reserve Power Co. Such disposal was made a condition by the commission with respect to its approval of the acquisition by Ohio Public Service Co., and indirectly by Cities Service, of all the outstanding common stock of Marion-Reserve.

HAS AUTHORIZED General Gas & Electric Corp. to pay a dividend of $1.25 on 32,110.9 publicly held shares of $5 prior preferred stock for quarterly period ending March 15, 1945.

Applications Filed

UNION ELECTRIC CO. of Missouri has filed a proposal to extend the date of maturity of its presently outstanding promissory notes in the aggregate face amount of $9,000,000, dated June 28, 1944, and bearing interest at 1½ percent annually, payable quarterly, pending the permanent financing of the payment of such notes. The notes are held by 44 commercial banks and were issued to provide, in part, funds for the repayment of the open account indebtedness owing to Union Electric by its subsidiary, Mississippi River Power Co., and a cash capital contribution to that company.

AMERICAN POWER & LIGHT CO. has joined the Texas Electric Service Co., a subsidiary, in filing a declaration covering several transactions which the latter company proposed to make to improve its capital structure to eliminate any necessity of incurring a large earned-surplus deficit and to reduce its bond interest and preferred stock dividend requirements by refunding its first mortgage gold bonds, 5 percent series, due in 1960, and its $6 perferred stock. The Texas utility is seeking commission approval for the issuance and sale of $18,000,000 principal amount of first mortgage bonds, due 1975, and $3,000,000 principal amount of 2½percent ten-year serial notes payable in annual or semi-annual installments, and also the issuance and sale or exchange of 68,875 shares of new preferred stock on a basis of one share of new preferred stock, plus an amount in cash equal to the difference between $110 and the public offering price on such new preferred stock, for each share of the presently outstanding $6 preferred stock.

CENTRAL VERMONT PUBLIC SERVICE CORP. has filed $6,967,000 of first mortgage bonds series D, due February 1, 1975, and 40,000 shares of no par value common stock. The bonds will be sold under competitive bidding. Proceeds from the sale of the bonds will be devoted to the retirement of a like principal amount of outstanding 3½ percent bonds. Proceeds from the sale of the common stock will be used for reimbursement of the treasury for moneys spent for expansion and other corporation purposes.

DALLAS POWER & LIGHT CO., a subsidiary of the Electric Power & Light Corp., has filed a registration statement, covering the proposed issuance and sale of 78,731 shares of $100 par value preferred stock. Dallas proposes to retire all of its outstanding 7 percent and $6 dividend preferred stock through the issuance of the new preferred which would be offered in exchange for the old preferred on a share-for-share basis.

Hearings Scheduled

MARCH 21: On plan of Engineers Public Service Co. to sell its interest in Savannah Electric & Power Co. to the Donner Estates, Inc.

MARCH 21: On proposal of United Light & Railways Co. to issue and sell privately to banks $17,000,000 of unsecured promissory notes to mature five years after date of issue. The company proposes to use the proceeds from the sale of the notes, together with treasury cash, to redeem as soon as practicable all of its outstanding 5½ percent debentures, due August 1, 1952 ($23,837,000 principal amount), at the redemption price of 102.

MARCH 22: On plan filed by Ohio Edison Co., a subsidiary of Commonwealth & Southern Corp., whereby Ohio would issue and sell at competitive bidding $26,000,000 of first mortgage bonds, with an interest rate not to exceed 3 percent per annum, due on April 1, 1975.

UTILITY REPORTS

	1945	1944
*Houston Lighting & Power	‡$2,985,032	$2,842,728
*Utah Power & Light and sub.	1,844,820	2,386,894
	1944	1943
†Birmingham Electric	‡1,552,082	1,340,943
†Carolina Power & Light	‡2,350,114	2,493,100
†Central Arizona Lt. & Pr.	723,492	893,045
†Central Ill. Elec. & Gas	706,162	932,237
†Commonwealth Edison and subs.	22,651,796	22,392,999
†Connecticut Light & Power	3,853,633	3,699,313
†Duke Power	4,822,134	5,156,231
†Kansas Gas & Electric	1,212,390	1,309,219
†Minnesota Power & Light	‡1,728,532	1,980,272
†Montana Power	‡4,168,658	4,181,531
†Pennsylvania Power & Light	‡5,645,583	5,828,009
†Washington Water Power and sub.	‡2,639,394	3,081,339

*Twelve months ended January 31.
†Twelve months ended December 31.
‡Preliminary.

Texas Bill Would Require Texans to Control Utilities

A bill to require resident ownership of majority stock in electric or gas utility companies operating in Texas has been introduced in the Legislature by Rep. Marvin Simpson, Jr. of Fort Worth.

Simpson would require that bona fide Texas residents hold majority interest, on the theory that they would have the state's welfare closer to heart than a citizen dwelling elsewhere. His bill also proposes that directors of these utilities meet only in Texas, that they keep all records there, and that none of the income from a Texas utility be given to a corporation outside the state.

The legislator has a companion law which would outlaw holding companies for any Texas corporation and prohibit any corporation there from owning stock in another concern.

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Energy Requirements Hit New High in January

January 1945 electric energy requirements indicate a new maximum with a total of 19,885,259,000 kw.-hr. an increase of approximately 594,000,000 kw.-hr. from December 1944 and of 2.4 percent over January of last year, according to preliminary figures announced by the Federal Power Commission. Preliminary figures on peak demands of the principal electric utility systems of the country for January 1945 aggregated 37,854,044 kw., a slight decrease of approximately 5,000 kw. from the preceding month, but a gain of 2.9 percent over January 1944.

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Key West, Fla., in Trouble

The electric system of Key West, Fla., is having difficulty in supplying power. There have been frequent interruptions in service because of plant failures. Recently when a bearing burned out, the city was without power for an hour or two each night, and for several days the city was without street lighting. Improvements at the plant will not be complete until December.

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Utility Coal Consumption

Electric utility power plants consumed 7,351,329 tons of coal in December, 1944, the Federal Power Commission has reported. Coal stocks of electric utility power plants as of Jan. 1, 1945 were 8.5 percent more than stocks of the same date last year, according to FPC.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

"Marsh Buggy" Built for Line Maintenance

It is a strange looking vehicle, shown in the illustration, and bears little resemblance to a line crew truck, but that is the purpose it serves for the Electric Distribution Division of New Orleans Public Service Inc. in maintaining a 110-kv. transmission line traversing a 10-mile stretch of Louisiana marsh.

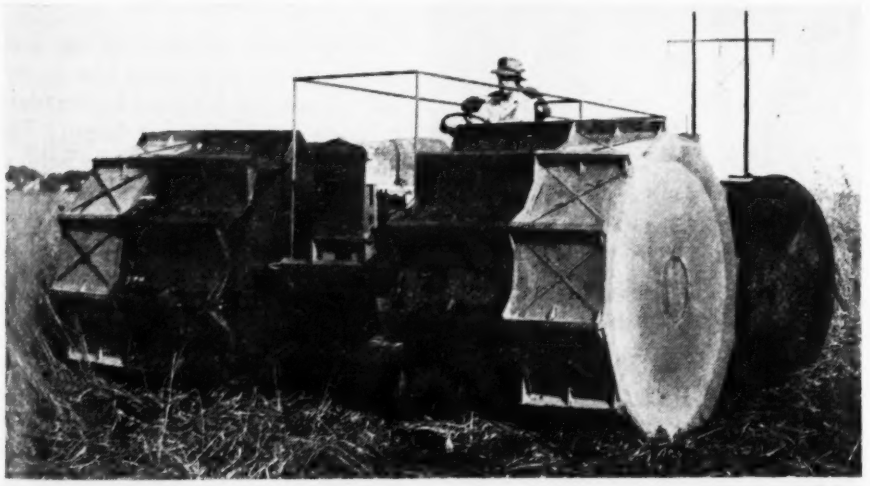
The "marsh buggy" was developed by the oil companies for transporting exploration crews over similar terrain and early models were equipped with very large rubber tires. Due to wartime conditions the electric company decided to build its own marsh buggy. Plans were based on designs and examination of actual models made available by the oil companies.

Welded steel water-tight drums 6 ft., 6 in. in diameter form the wheels, since experience had proved them to be more satisfactory than rubber tires. Finding that additional traction was needed for very soft spots in the marsh, plywood extensions (outer sections) were added to the front driving wheels. As these extensions were also made water-tight, they provide extra buoyancy in water.

Power is provided by a four-cylinder Ford engine driving through its regular automobile transmission and a modified differential. A special clutch is provided by which both driving wheels can be made to turn together, in case one wheel should lose traction in a soft spot. A chain drive transmits the power to the front wheels.

Steering on land is accomplished with the rear wheels which are connected to an automobile steering gear. In water the marsh buggy is steered by stopping one of the driving wheels.

In a test run over the stretch of the transmission line crossing the marsh, the buggy operated very satisfactorily over both marsh and water. It was particularly effective in getting through canals and bayous choked with water hyacinths, where even travel by boat is an extremely difficult operation.



"MARSH BUGGY" in its natural habitat, serves as crew truck for transmission line maintenance. Equipment is carried in the tool box between the rear wheels

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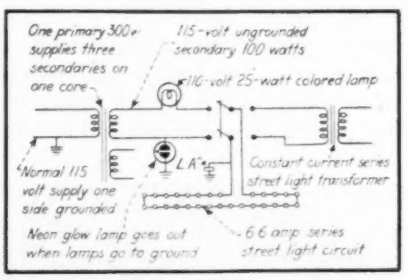
Low-Voltage Transformer Tests Lighting Circuits

By J. P. DAWSON
Meter Engineer, Woodstock (Ont.) Public Utilities Commission

Our series street lighting circuits were formerly grounded by two rods for each circuit at the station during the day. This had three bad faults: It put ground potential on the poles creating a hazard for the linemen; during lightning storms it created a path for the lightning through the lamps to the station; and last but not least it gave no means of testing until the station operator got an okay from the line department that the men were all clear.


One primary 300-v supplies three secondaries on one core
115-volt ungrounded secondary 100 watts
110-volt 25-watt colored lamp
L A
Normal 115 volt supply one side grounded
Constant current series street light transformer
Neon glow lamp goes out when lamps go to ground
6.6 amp series street light circuit

MULTIPLE-COIL transformer tests series lighting circuits without incurring the hazards of grounding

To overcome these faults we had made to order an isolating transformer of 300-watt capacity wound with three secondaries of 100 watts each, with 4,000-volt insulation between coils and to ground. Now the operator pulls the rods and replaces them to cut each circuit in series with

a colored 25-watt lamp across one secondary. Each secondary has a neon glow lamp connected to one side and ground. We use transformers with three secondaries so that failure of one would not interfere with too many circuits. The system works very satisfactorily in the following manner:—

The operator plugs in the jacks and the colored lamp lights, putting 110 volts on the lamps but not grounded. The neon lamp lights to show no grounds on the system. If the colored lamp goes out during the day either the line is broken or a lamp has not been reseated completely during relamping. If this occurs the line department is notified and the circuit closed before the linemen go home at night. A dead lamp or a blown fuse will not affect the operation. If lightning strikes it blows the 25-watt lamp and during eight such occurrences it has not exploded any of them. Lightning arresters lower the crest and save the series lamps in the circuit beyond them.

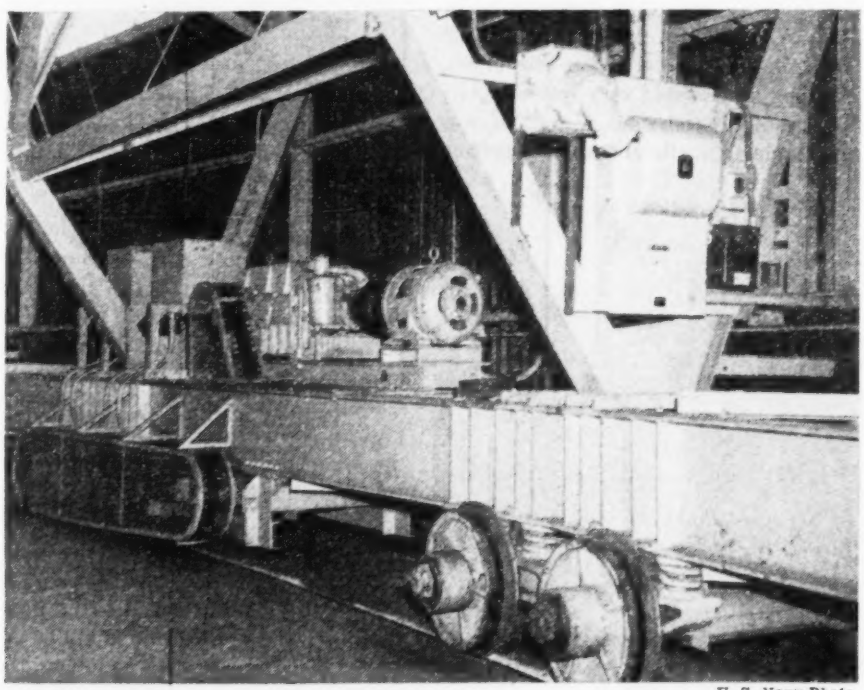
Hangar Doors Have Novel Motor Drive

To operate the end doors of a hangar at the U. S. Navy's dirigible base in South Weymouth, Mass., an advanced type of motor drive was required because of the size of the doors and the importance of being able to open or close them speedily. At each end of the hangar the opening is 322 ft. wide by 190 ft. high. The doors are of the orange peel type, the equipment being designed by Byrne Doors, Inc., Detroit, Mich., and detailed by the Bureau of Yards and Docks, Washington. In effect, there are quarter domes joining in closed position and rolling aside the hangar when open. Each opening has two leaves with 36 wheels per leaf to carry the supporting steel structure of the door section, every wheel being designed for a maximum vertical load of 20 tons and a maximum horizontal thrust of 7.5 tons.

Operation is obtained by four power-driven door trucks at each leaf. Five idler trucks support portions of the door between the power trucks. The door speed is 36 ft. per min., opening or closing taking 6 min. Each power-driven truck unit has a 25-hp. 240-volt, 3-phase Century induction motor attached to a heavy duty hydraulic coupling to whose shaft is connected a Thrustor operated brake. An extension of this drive shaft is geared into a 100 to 1 speed reducer (rated at 30 hp. and 1,200 r.p.m.), from which chain-driven sprockets transmit power to the flanged wheels of the truck. Each door has two drum controllers, one at each end. When either is operated, a master relay is closed, starting the four motors simultaneously through individual starters.

Travel Control

Door movement is governed by Cutter-Hammer limit switches, which, when contacted, allow the door to coast until final limit switches are turned off, thereby setting the brakes and stopping movement. Final closing action is by tightening jog buttons. The unusual use of two sets of limit switches was dictated by the necessity of eliminating excessive strain on the door structure in abrupt closing. To insure satisfactory braking under the prevailing climatic conditions at all times, electrically controlled sand boxes are attached to the power trucks. The sand is heated to flow freely and is automatically spread on the tracks, a 1-hp. motor-driven compressor being provided. A 1/10-hp. motor-driven pump is also installed on each truck, which is also equipped with an emergency plug for a 175-kw., 240-volt mobile generating unit driven by a gasoline engine for use in case of temporary interruption of the power supply to the hangar.



U. S. Navy Photo

ONE OF THE 25-HP. MOTOR DRIVES, four of which are required per door section, operating in hangar nearly 200 ft. high; door speed 36 ft. per min.

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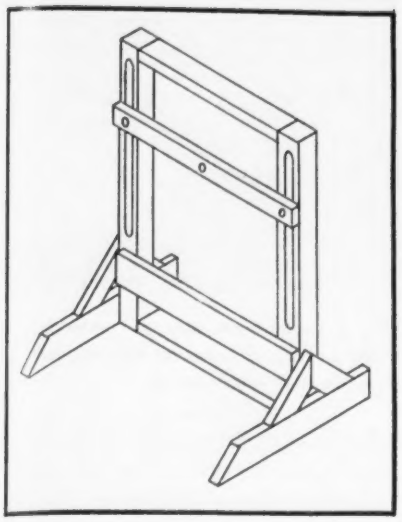
Slotted Frame Holds Any Type of Meter

By A. R. CONSTANT, JR., & J. H. ARMSTRONG

Meter Testers, New England Power Co. Tewksbury, Mass.

Every meter department has been faced with the problem of how to support meters not designed for standard supports set in the test board. The following describes a meter holding frame that will handle any size meter-watthour or indicating.

Two pieces of any type wood, 1½ by 1½ by 24 in. are fastened together top and bottom by pieces 1½ by ¾ by 14 in. The uprights are spaced 14 in. apart and have a ½-in. slot running 1 in. from the top to about 4 in. from the bottom. Feet are made of 2½ by ¾ by 15 in. boards fastened to the bottom of the upright as shown. Braces from the feet to the upright complete the rigidity. A board 2 by



RACK for odd-shaped and odd-sized watthour and indicating meters

¾ by 17 in. is fastened across the uprights at the angled pieces. A similar size board with two ½-in. holes ¾ in. from each end is the movable piece. In addition, the movable piece has a ¾-in. hole through the center to handle meters with a holding stud in the center of the base near the top. Two ¾-in. carriage bolts with wing nuts and washers hold the movable board in place.

The movable bar can be moved so that the bottom of any meter can rest against the rigid piece fastened near the bottom. This will take care of all watthour meters. Indicating instruments are taken care of by bringing the movable bar down so that it forms a vise to seize the base of the meter.

Reproduced Tracings Save Drafting Time

Considerable drafting room time is being saved by Public Service Co. of Indiana, Inc. through a "reproduced tracing" procedure that eliminates the necessity for making a separate set of drawings for each new job involving a minor variation of a conventional substation design.

The system used is built around a single set of "basic design" tracings for each standard substation used on the company's system. This set of basic tracings show the principal station elements that are common to a particular design and include general structural design, plans sections and grounding details. Omitted, however, are electrical connections, arrangement of incoming and outgoing lines, apparatus and other elements that differ from job to job.

Modified Tracings

Starting with this set of tracings when a job comes up for design, "reproduced tracings" are prepared on thin paper by the Ozalid or some similar reproduction process yielding dark lines on a white background. These secondary "tracings" are then modified to show connections and special job details that are peculiar to the particular substation being designed. Means are available depending on the process used, for erasing of blocking out unwanted portions of the basic design on the reproduced tracing if the need requires. When the missing details are filled in on the secondary tracings, conventional blue prints are made from them to serve as working drawings on the job by the employees.

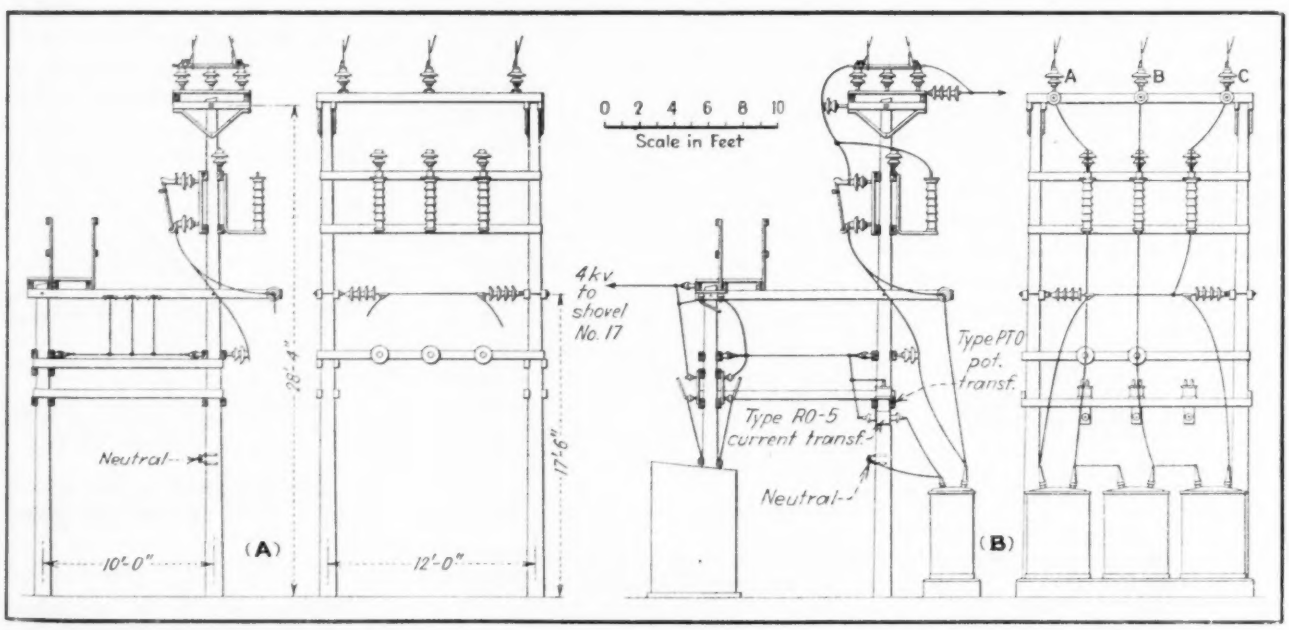
The accompanying basic and final design drawings for a small 33 kv. substation are shown to illustrate the method. Note the addition of outgoing and incoming lines, disconnect switches, current and potential as well as main power transformers, circuit breaker cubicles and the removal of certain dimensions. Other drawings from the basic set are altered in like manner.

•

Lightning Capsules Locate System Faults

Magnetic links identical with those used on tower legs to estimate values of lightning currents are used on The Shawinigan Water & Power Co. system to determine fault current magnitudes. From known values of impedance the fault is often located to within 2 percent of its true distance although the error is occasionally much greater.

At the present time, fault locators



DESIGN DETAILS OF A PARTICULAR SUBSTATION added to "reproduced tracing" made from master tracing (A) lead to working drawing (B). Process reproduction of master tracing eliminates hand reproduction by draftsman

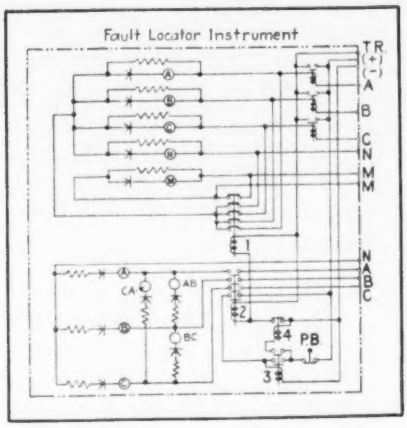


FIG. 1—Five current and six potential recording elements and circuits each with shunted or series resistor and rectifier

are in service on a total of 725 miles of steel-tower lines, operating at 110 kv., 165 kv., and 220 kv.

During a three-year period ending December 31, 1944, the operational experience has been somewhat as follows:

Number of fault locator operations	46	
Number of faults found within 10% of line length	34	(74%)
Number of faults found between 10% and 20% of line length	4	(9%)
Number of faults not found	8	(17%)
Total	46	(100%)

In addition to the above operations, which were for respective line faults only, many other operations were obtained for faults external to the respective line and associated fault locator. These additional fault locator operations have proven of considerable help in the analysis of system troubles.

Appropriate magnetizing effect is obtained on the standard 1½-in. magnetic links by placing them as the core of coils carrying fractions of the fault current and voltage. The coils are 2 inches in diameter on 17/32-in. form and 1-9/16 in. long; the voltage

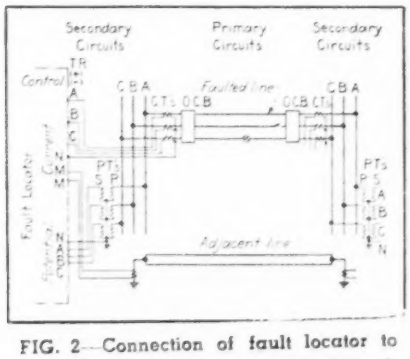


FIG. 2—Connection of fault locator to primary system has been made through instrument transformers

coil has 5,000 turns of No. 30 wire and the current coil 900 turns of No. 20. Further details are given in a comprehensive paper by E. W. Knapp in the July 1941 issue of *The Engineering Journal* (of the Engineering Institute of Canada) from which the following facts have been drawn.

A rectifier is inserted in each coil circuit to convert the alternating fault current or voltage to a unidirectional current capable of magnetizing the link (Fig. 1). The degree of magnetization imparted is therefore a measure of the fault current and, in conjunction with known line impedances, of the fault location. The surge-crest ammeter is used to determine link magnetization as in lightning practice.

The recording units are blocked after a fault from further actuation by suitable relaying until the links can be removed and replaced. Four such panel-mounted installations have been made on four 110-kv. parallel lines (each 85 miles long) in a solidly grounded wye system and two more on a 220-kv. line about 100 miles long.

•

Vertical Guide Bearings

II—Friction Energy

By H. W. HAMM,
Designer, S. Morgan Smith Co., York, Pa.

A method for determining power loss due to fluid friction on guide bearings of vertical waterwheel shafts was outlined in ELECTRICAL WORLD, March 3, 1945, page 119. The discussion is continued for guide bearings operating loaded and unloaded.

Eq. 1, 2 and 3* are statements of Petroff's law for bearings. A test of the validity of this law for guide bearings without load has recently been made by Hagg (see Reference 2 and Fig. 1). It shows that the law can be used with a high degree of accuracy up to surface velocities of U = 500 inches per second. It is also valid for bearings which are loaded to such an extent that ideal fluid friction conditions still exist, i.e. for a bearing constant $S_z = \frac{Z_n}{P} \geqq 100$. The friction energy produced by an unloaded bearing therefore is the same

* Equations, illustrations and references are numbered consecutively for the series of three articles. References are listed at the end of each article.

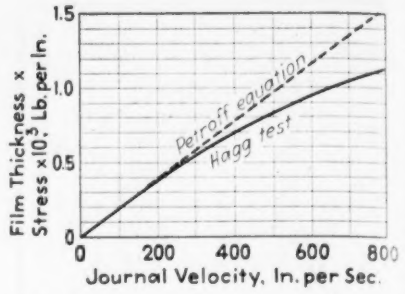


FIG. 1—Shearing stress for unloaded guide bearing at constant bearing temperature (see Reference 2)

as that of a bearing under load. For $S_z \leqq 100$ the friction energy increases gradually with decreasing S_z due to the fact that ideal friction conditions no longer exist. For bearings under load Petroff's law can be written in this form

$$M = \frac{f p \pi D^2 L}{2} = \frac{D^3 L n \mu}{6C} = \frac{L}{6.9 \times 10^6} \times \frac{D^3 n Z}{C} \quad (4)$$

where f = Coefficient of friction, dimensionless

p = Unit load on projected area of bearing, pounds per square inch.

Note: See Reference 1, page 14, for converting μ to Z.

In Fig. 2, Eq. No. 4 and a test curve for the same conditions have been plotted. They show that unloaded guide bearings and bearings under load operate under substantially the same friction load, (see Reference 1, page 24).

The energy thus produced by friction must be dissipated into the air surrounding the bearing in order to establish a thermal equilibrium at the desired oil film temperature of approximately 130 to 150 deg. F. This

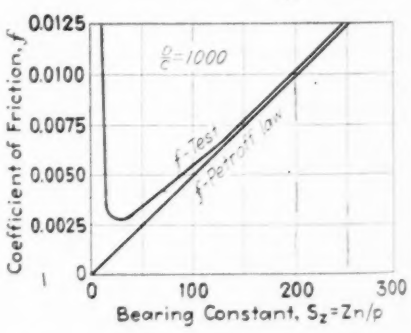
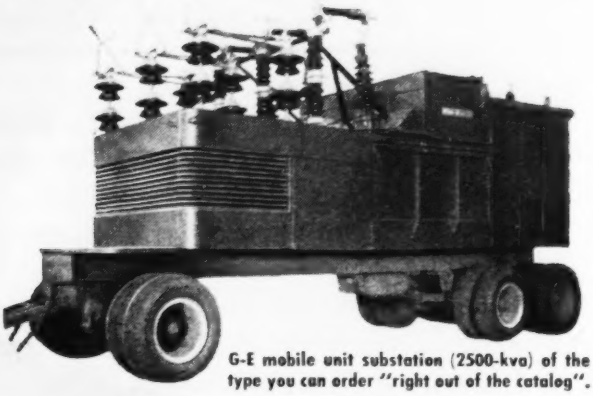


FIG. 2—Friction load for loaded and unloaded guide bearings (see Reference 1)

References in this article:
1. Lubrication: A. E. Norton; McGraw-Hill Book Co., New York, 1942, page 16.
2. Heat Effects in Lubricating Films: A. C. Hagg; *Journal of Applied Mechanics*, June 1944.

20 more good reasons for

REPETITIVE MANUFACTURE



G-E mobile unit substation (2500-kva) of the type you can order "right out of the catalog".

"RM"—for Repetitive Manufacture—is becoming a designation of increasing importance in the purchase of power transformers, unit substations, and switchgear, and even mobile substations. General Electric applies it to those types and ratings that are so widely applicable—and so well-accepted—that we can build them repetitively.

In these wartime days, we sometimes receive a single order which, of itself, proves the case for repetitive manufacture. In building the equipment to a standard design, we accomplish important savings in engineering time for the buyer, and in production time at our plants. Uniform operating practices are easy to establish; costs of maintenance and of stocking spare parts are sure to be low.

As you plan your future purchases of heavy power apparatus, let us work with you along this route toward lower investment and operating costs. *General Electric Company, Schenectady 5, N. Y.*

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Incoming voltages—11 to 69 kv
Outgoing voltages—below 15 kv

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THE BUYER GAINS
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Less maintenance cost per year

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Repetitive-Manufacture

A discussion of advantages from

You can reduce your investment costs by specifying transformers with RM-listed kva ratings and utilizing their "loadability."

THE custom of specifying a transformer kva rating to match an "exactly" calculated load arose from a natural desire for economy. But as a result, transformers have been built in almost every intermediate step from 667 through 10,000 kva, requiring special treatment in design and manufacture that added to the cost.

How often was the "exact" kva rating needed really known or even accurately calculable? The general manager of an Iowa power company writes:

"In looking over our experience during the past years, I can readily see where, in practically all cases, we could have adapted our requirements to enable us to use a standardized product."

By ordering from a range of carefully selected, *listed* ratings, you gain all the benefits that can be realized through repetitive manufacture, such as lower prices, quicker shipment, simplified purchasing, and an improved product.

The kva ratings selected for General Electric RM-listed power transformers conform to those listed as "preferred" by ASA for step-down service: sizes chosen as the result of many years' operating experience in the range 667 to 5000 kva, single-phase; 750 to 10,000 kva, three-phase—2400 to 66,000 volts.

These ratings permit a practical and economical choice for most applications, and are often the logical choice because:

1. KVA LOADING AND LOAD GROWTH CAN ONLY BE ESTIMATED.

Actual kva loadings on substation transformers, for either power-company or industrial applications, depend on many variables, including diversity. These variables make it extremely difficult to figure the load very accurately. Also, it is usually desirable when selecting a kva rating to provide for several years' load growth in order to avoid too frequent transformer replacement. An RM-listed rating which will provide a suitable margin can generally be selected.

2. HIGH SECONDARY CURRENTS RESULT IN UNECONOMICAL DISTRIBUTION.

Study may show that choice of a higher voltage, or division of the total transformer capacity into two or more smaller RM-listed units, will make it possible *to save on over-all system costs, conserve copper, reduce circuit-breaker interrupting duty, and provide better voltage conditions.*

EXAMPLE A: Economic studies show that, at 480 volts, a typical distribution system which utilizes three-phase RM-listed power transformers rated 750 kva will be 25 per cent less costly than a comparable system in which the

Power Transformers

*the standpoint of KVA RATING**

required transformer capacity is installed in units rated 3000 kva or larger.

EXAMPLE B: Similar studies have revealed savings of as much as 50 per cent in system costs, when RM-listed power transformers were used with 480 volts as the secondary distribution voltage, instead of 240 volts.

3. TRANSFORMER "LOADABILITY" SHOULD BE CONSIDERED.

The ASA recognizes that, under many conditions of operation, transformers can carry, for short periods, loads which exceed the nameplate kva rating. Thus, a 5000-kva self-cooled transformer, initially carrying no load, can carry an emergency overload of 7500 kva for two hours.

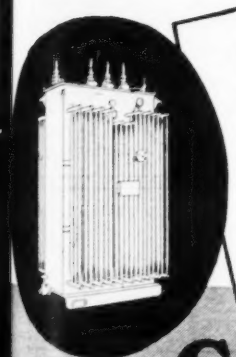
The AIEE indicates somewhat larger emergency loadings, with only moderate sacrifice in transformer life expectancy. Thus, the same 5000-kva transformer, initially carrying full load, on this basis could carry an emergency overload of 8500 kva for two hours.

Such transformer "loadability" should be carefully considered before kva ratings other than RM-listed ratings are specified. If short-duration peak loads are the main reason for the "special" rating, study of the loadability curves of standard units may show that an RM-listed rating slightly lower than that of the "special" will be suitable for the job, and that a considerable saving in cost can be made.

4. FORCED-AIR COOLING GIVES FLEXIBILITY TO NAMEPLATE RATING.

The forced-air-cooled kva rating of RM-listed transformers is either 25 or 33⅓ per cent more than the self-cooled rating, depending upon size; yet winding temperatures (average and hotspot) are within ASA limits. Forced-air cooling affords an attractive means for handling repeated or frequent peak loads or seasonal overloads, even though the higher losses and greater voltage drop that occur at the increased rating may tend to make its use undesirable for continuous forced-cooled operation. Properly applied, forced-air cooling can save unnecessary investment.

*This is the first in a series of messages designed to help you select and apply RM-listed power transformers—to help you gain the maximum benefit from them. Ask for Booklet GEA-4283 for complete descriptive information on RM-listed G-E power transformers, and Booklet GEA-4338 for additional data on how to select and apply these transformers. *General Electric Company, Schenectady 5, N. Y.*



RM-listed power transformers and unit substations are the result of repetitive manufacture of standard designs. Many of the parts used are manufactured in large quantities and carried in stock. The benefits to you: Quicker shipment (about 33 per cent less time), lower cost (6 per cent less), and simplified purchasing.

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and keep all you buy

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range is a safe value for favorable heat transfer conditions. Above this temperature the oil tends to evaporate and deteriorate enough to require frequent additions of fresh oil.

Transfer of heat, energy loss, and remedies for overheating will be presented in a subsequent issue.

•

Drinking Fountain for Line Truck

Because they were often out of drinking cups and because a crew will invariably litter the street with paper cups on a several hours' job, one Pacific Gas & Electric Co. foreman has equipped his line truck with a drinking fountain as shown. Water is carried in a section of an ordinary

WORKMEN PREFER this portable drinking fountain on line truck to paper cups. The idea came from the foreman shown at the fountain who prefers it too, as the street is no longer littered with paper drinking cups

30-gal. galvanized (hot-water) tank mounted in the corner of the truck. Occasionally the water is chilled with ice.

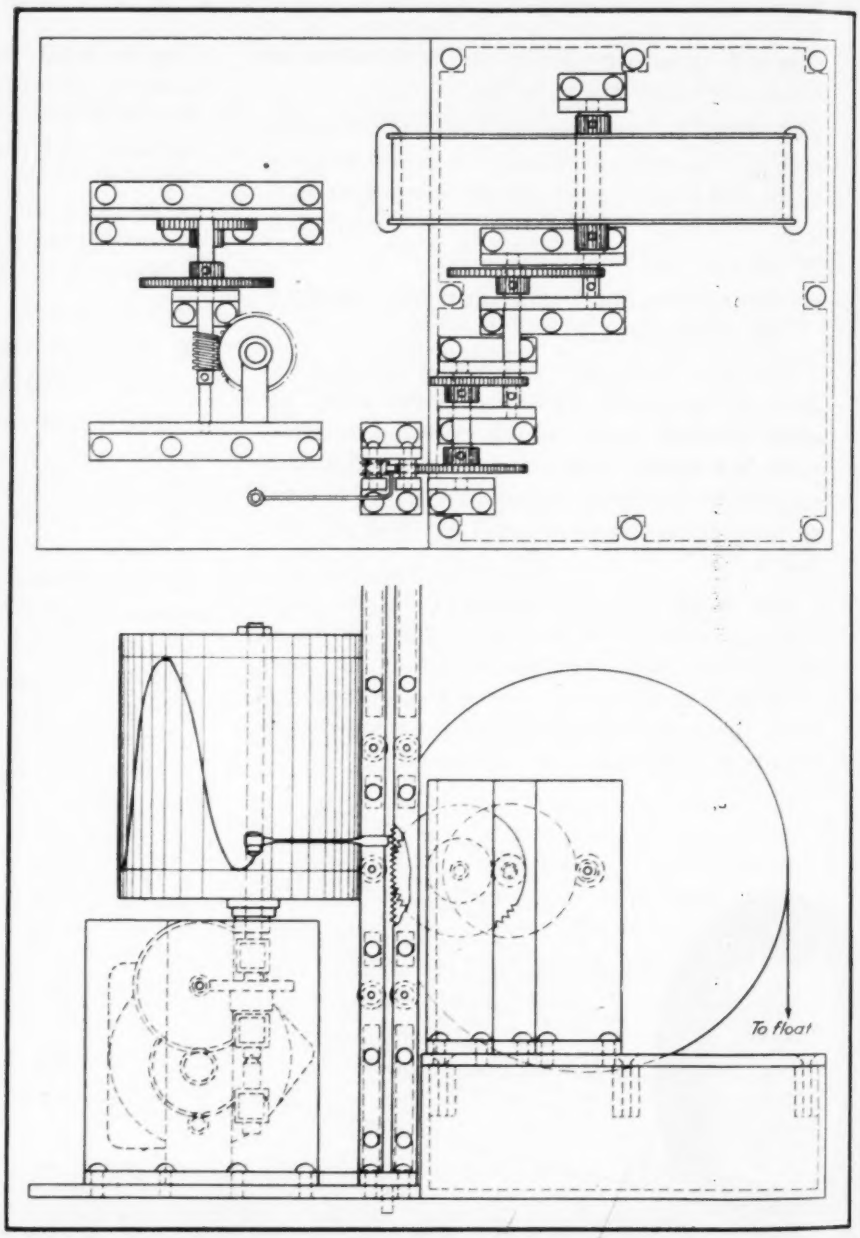
The drinking fountain is more wasteful of water than cups, but this is not an important factor because the tank carried is of ample capacity. Workmen much prefer this portable drinking fountain to paper cups or any other method of dispensing water used in the past.

Chart Records Tide Elevation

By M. R. PESCHKE
Queens Borough Gas & Electric Co.
Far Rockaway, L. I., N. Y.

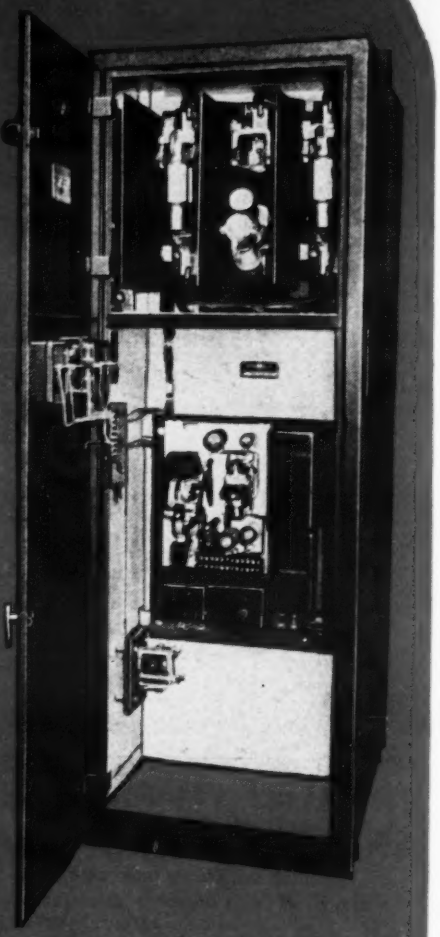
Meter to indicate and record tide elevation at the generating plant where sea water is used for cooling purposes has given satisfactory results for several years. The meter's component parts are a chart-holder drum, pen, two sets of gear trains, telechron motor, and a drum which is actuated by the float and, in turn, by the tide.

The telechron motor is connected through a gear train to the chart-holder drum which revolves once in seven days. The pen which is held by a 1¾-in. arm is actuated through a gear train of such ratio that an 8-ft. deviation in water elevation produces a 3-in. movement of the pen. The float (not shown) is connected to a monel metal stranded cable $\frac{3}{32}$-in. in diameter. This cable is wound twice around its drum to prevent slipping and has a 1 lb. counterbalancing weight on the other end. The complete unit is housed in a salvaged glass meter case.



TIDE-WATER METER whose chart-holder drum is made from a can 3⅝-in. in diameter and 3⅞-in. high. It has two disks soldered in as shown and these have a ¼-in. center hole for the shaft. The flanged float-actuated drum is made of a 6⅞-in. can cut 1⅜ in. high. Gear arrangement shown at top

HOW LIMITAMP CONTROL PROTECTS YOUR MOTOR



1/2-CYCLE OPERATION clears high-voltage fault currents before they can do harm

LIMITAMP control, for use with squirrel-cage, synchronous, and wound-rotor motors, provides fast, positive short-circuit protection so necessary for safe operation at high voltages.

Your Motor Is Protected by These Three Limitamp Features

1. **½-cycle Operation**—By means of Type EJ-2 fuses, a rise in current due to a short-circuit is cut off in less than one-quarter cycle, and cleared in less than one-half cycle—long before fault currents can harm your motor.

2. **Efficient Overload Relays**—Accurately calibrated against actual motor characteristics, isothermic overload relays protect your motor from overheating due to sustained overloads, locked rotor, or single-phasing.

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Air-break contactors, designed to meet the most severe requirements of high-voltage motor-control service, are co-ordinated with the EJ-2 fuses. Because the full short never passes through these contactors, it is possible for them to have a mechanical life of several million operations, and contact-tip life many times that of conventional devices. Bulletin GEA-4247 gives a well-illustrated description of all the features that make Limitamp control tops in the field of high-voltage control. Ask our local office for a copy, or send the coupon direct to General Electric Company, Schenectady 5, N. Y.

On voltages up to 4200 volts, the interrupting capacity of Limitamp control makes it the logical answer for any application where high-voltage fault currents are encountered.

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HOW TO DETERMINE LOW POINT OF A SPAN WITHOUT USE OF A TEMPLATE

By M. F. BEALL, Engineer, Transmission Design Unit,
U.S. Bonneville Power Administration, Portland, Oregon

Mathematical analysis of conductor sags in transmission lines involving spans with supports at unequal elevations can be made by use of equations developed for the purpose and without having to plot the catenary curve.

Equations for the analysis are:

(1) $y = H/w$ (Cosh wx/H)

(2) Sag $= H/w$ (Cosh $wx/H - 1$)

(3) $H = T - w$ (Sag)

(4) $M = H\left(\frac{\text{Length of Cable}}{\text{Length of Span}}\right)$

(5) $$\text{Sinh}\,\frac{wx}{H} = \frac{wD}{2H}\left[\frac{\text{Sinh}\,\frac{ws}{H}}{\text{Cosh}\,\frac{ws}{H} - 1}\right] \pm \sqrt{\left(\frac{wD}{2H}\right)^2 + \frac{1}{2}\left(\text{Cosh}\,\frac{wS}{H} - 1\right)}$$

(6) $$\text{Sinh}\,\frac{wx}{H} = \frac{wD}{2H}\left(\frac{\text{Sinh}\,wS/H}{\text{Cosh}\,wS/H - 1}\right) \pm \text{Sinh}\,wS/2H \text{ (approximate)}$$

where y = Point on curve in relation to x (equation of catenary curve)
x = Distance from low-point to any point on the catenary.
w = Weight of cable per unit length.
H = Horizontal component or low-point tension in the cable.
T = Support tension in the cable.
M = Average tension in the cable.
S = Span length
D = Difference in elevation between supports.

Location of the low-point of sag is determined exactly by Eq. 5 for all cases. It is determined approximately by Eq. 6 for spans in which the difference in elevation between the supports is small in comparison with the span length.

Example

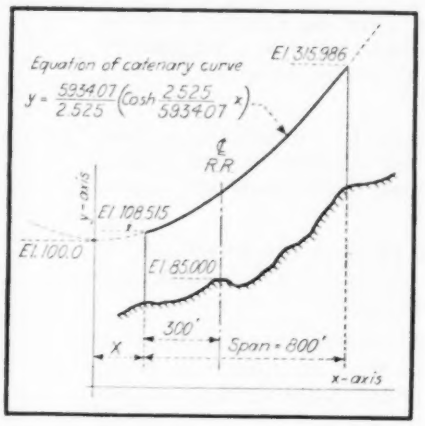
Given: Physical data for a crossing span over a railroad are shown in the illustration. Conductor is ACSR "Drake" strung on a 700-ft. ruling span. Maximum working tension is 6,000 lb. (wood pole construction) at a design loading of ½ in. ice, 8 lb. wind, zero deg. F.

Calculate: Clearance of conductor over the centerline of the railroad, under maximum design loading.

Solution: Unit weight of the conductor (plus ice and wind) under maximum design loading is 2.525 lb. per ft. Sag in a 700 ft. level span in which the support tension under the above loading is 6,000 lb. may be calculated by use of Martin's Tables or from the catenary equation for sag (Eq. 2) and is found to be 26.11 ft.

Horizontal tension of the ruling span is determined by Eq. 3 and found to be 5,934.07 lb.

The conductor in the span will form a segment of a curve represented by Eq. 1 and shown in the illustration. The problem is to locate the given span with reference to the low-point of the catenary curve.



CLEARANCE of a conductor span over a railroad for (1) given data and (2) computed data, without the aid of a template or plotting of any kind

The low-point is located by Eq. 5 in which the following values are substituted:

$D = 207.471$ $\quad w = 2.525$

$H = 5934.07$ $\quad S = 800$

$\frac{wS}{H} = 0.340407$ $\quad \frac{wD}{2H} = 0.044141$

$\text{Sinh}\,\frac{wS}{H} = 0.347020$

$\text{Cosh}\,\frac{wS}{H} - 1 = 0.058500$

Solving the equation:

$\text{Sinh}\,\frac{wx}{H} = 0.085212$ and 0.438472

and $x = 200.01$ and 1000.03

Thus the low-point of the catenary curve is 200 ft. from one support and 1000 ft. from the other support. The horizontal difference between the distances is 800 ft. which is the span length; thus it is a check on the accuracy of the results, and an indication that the low-point of the catenary is outside of the given span.

Using Eq. 2 for sag and letting x equal 200 ft. and again 1000 ft., a check is made for the difference in elevation between the supports and the elevation of the low-point is determined.

Center line of the railroad is 300 ft. from the lower support or 500 ft. from the low-point. Letting x equal 500 ft. in Eq. 2, the sag is 53.388 ft.

Determine Clearance

Clearance in feet between the conductor and centerline of the railroad track is then computed from elevations, as follows:

Elev. low-point	100.000
Sag.	53.388
Elev. of cable over track	153.388
Elev. of track	85.000
Clearance	68.388

The vertical load on the upper support is equal to the weight of a length of the loaded cable extending along the catenary curve from the upper support to the low-point. The vertical load on the lower support is an uplift equal to the weight of the loaded cable whose length equals the length of the catenary curve from the lower support to the low-point. These vertical loads are due to this one isolated span.

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Revere Condenser Tubes are preferred because of their long, satisfactory service, and so are Revere Plates, for the same reason. The two make a perfect combination, both being made with the same high skill, to the same standards.

Our long experience makes it possible to deliver to you plates that are dense, free from blow holes and surface imperfections, characterized by flatness, accuracy of gauge, machinability and resistance to corrosion.

Revere Condenser Tube Plates are available in squares, rectangles, circles, half-circles, segments, patterns, up to 120 inches. Finished weight, up to approximately 11,000 pounds. Metals include Admiralty Metal, Muntz Metal, Naval Brass and Cupro-Nickel, where authorized. Revere Condenser Tubes are available in these, and also in Revalon (aluminum brass). Other Revere products for power plants include copper tube and pipe, Red-brass pipe, copper bus bar, Herculoy (silicon-copper alloy) in plate, sheet, strip, rod, forgings. For advice in the selection of the proper non-ferrous alloys for your purposes, write the Revere Executive Offices.

Pouring a 12,000-pound cake of Revere Cupro-Nickel for a Navy Condenser Tube Plate.

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DRAFTING LAYOUT OF POLE LINES

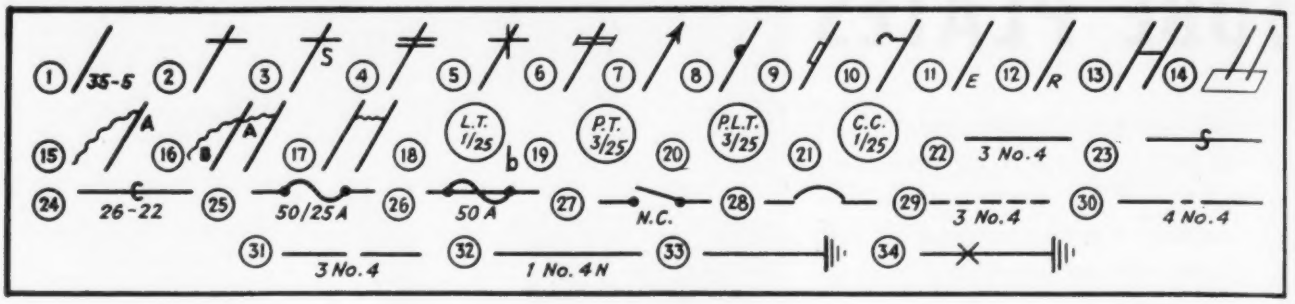
By W. E. BARRON, Boston, Mass. and PHILIP MORRILL, Windham, N. H.

A point-to-area type of pole line has been developed to carry service wires often for several voltages from a centrally located switchgear to various units erected at points over a wide area.

For this recent scheme a new system of symbols and plot layouts have been designed; see illustrations. Plant layout is to scale preferably 1 in. = 50 ft. Pole symbols are about ¾ in. high, slope 30 deg. to right from the vertical, and the butt end indicates actual point of setting. Crossarms are either horizontal or vertical lines, depending on direction of pole line run. Template may be cut in celluloid or a thirty-sixty degree triangle to speed drawing of symbols.

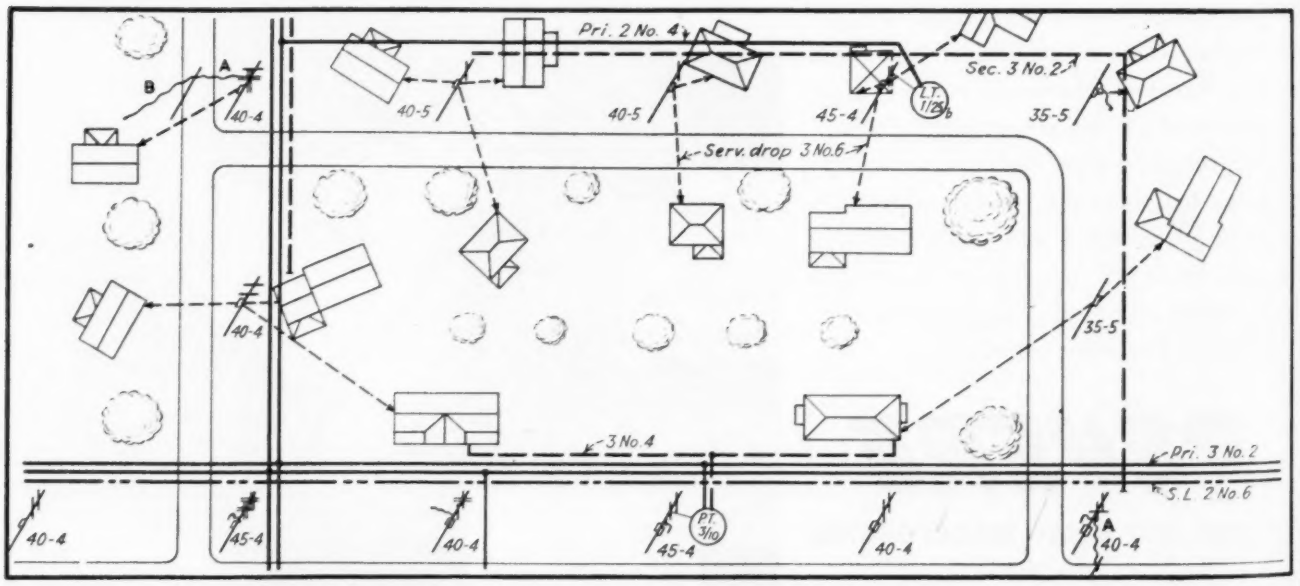
Wires are shown near the poles and are run in a convenient location to avoid interference with other items on drawing. Buildings may have their demand load marked on them. Lighting load is expressed as kw., power load as kva.

All strictly electrical data on the drawings are drawn quite heavy while buildings, roads and topographical features should be much lighter but heavy enough to print well.



POLE LINE SYMBOLS

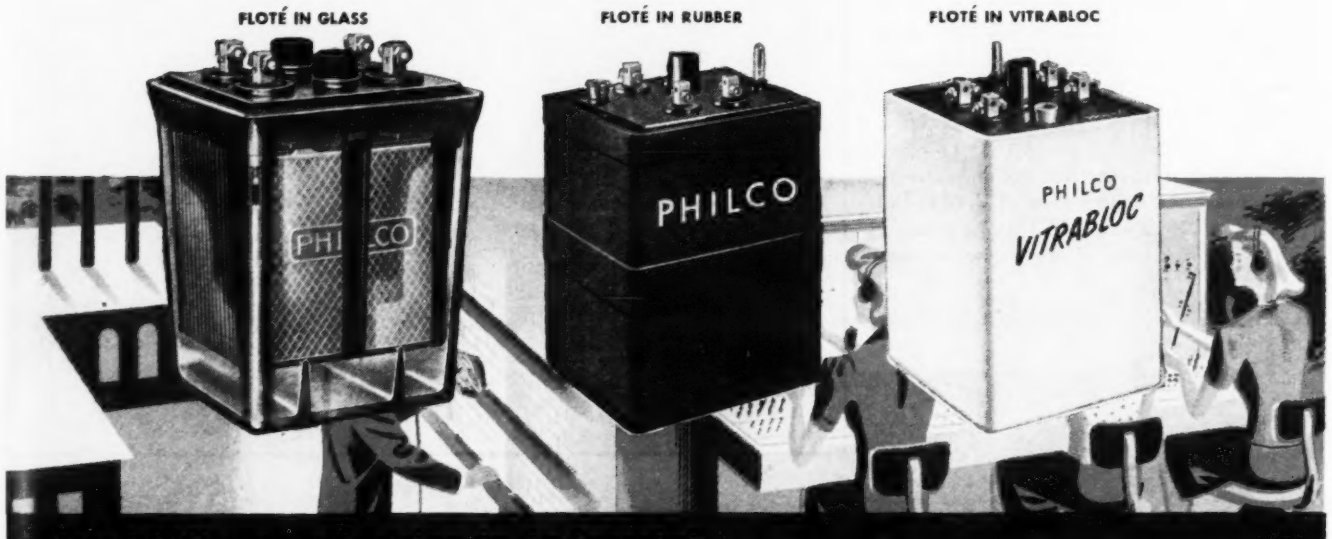
1—Pole; butt end locates point of setting. Numerals indicate 33-foot Class 5 pole.
2—Pole with crossarm
3—Pole with secondary or low-voltage crossarm indicated by letter S.
4—Pole with double arm
5—Pole with buckarm
6—Pole with double arm and dead end
7—Pole with pole top pin
8—Pole with telephone or control cable
9—Pole with secondary rack
10—Pole with street light
11—Existing pole to be used
12—Pole to be replaced
13—Pole mounted transformer platform
14—Poles with transformer pad
15—Pole with down guy. Letter indicates strand size; A = ⅜ in. S-M strand; B = 7/16 in. H.S. strand.
16—Pole with stub guy
17—Pole with line guy
18—Lighting transformer; indicates one 25-kva. 1-phase, 240/120-volt, 3-wire; b indicates connected on phase b.
19—Power transformers; indicates three 25-kva, 1-phase, 480-volt; for 3-phase secondary.
20—Power-light transformer; indicates three 25-kva, 1-phase, transformers connected for 208/120-volt, 4-wire secondary.
21—Constant-current regulator; indicates one 25 kw.
22—Primary line; number and size of wires as marked.
23—Series lighting circuit
24—Control cable; indicates 26 pairs No. 22 gage wire
25—Fused cutout; indicates 50-amp. cutout fused for 25 amp.; transformer cutouts not shown.
26—Cutout with solid blade
27—Disconnect switch; N.O. = normally open; N.C. = normally closed.
28—Circuit breaker
29—Lighting secondary; 240/120 volt, 3-wire, 1-phase.
30—Power-lighting secondary; 208/120 volt, 4-wire, 3-phase.
31—Power secondary; 480-volt, 3-wire, 3-phase
32—Neutral wire
33—Ground
34—Lightning arrester; transformer lightning arresters not shown.



Typical layout for a primary and secondary pole line of the point-to-area type

Makers of the famous Philco "THIRTY"

Consistently through the years users of PHILCO Storage Batteries have been *first* to get the major developments contributing to high capacity, greater efficiency, longer life, lower cost. One of these great Philco "firsts," developed for the special needs of utilities engineers, is the Philco Floté grid that eliminates low cells in modern full float service. Experience has demonstrated the economy and low cost of this basic engineering advantage available only in Philco Batteries. For specifications write—Philco Corporation, *Storage Battery Division,* Trenton 7, N. J.



For 50 Years a Leader in Industrial Storage Battery Development

HOW TO DETERMINE CONDUCTOR LOADING

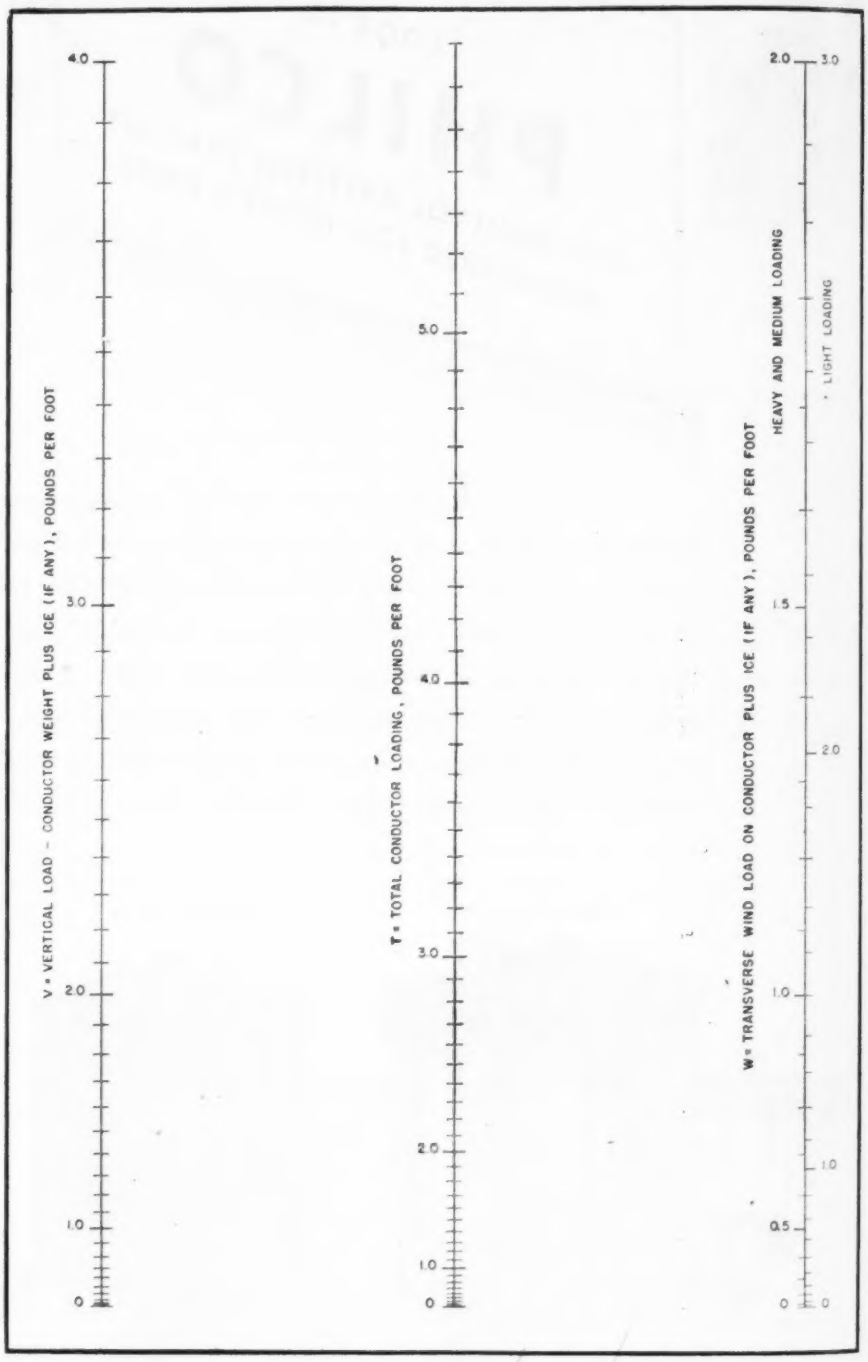
Nomograph yields vertical, transverse and conductor loads in pounds per linear foot of conductor. It is adapted from recently published Discussion Handbook H39, National Electrical Safety Code, part 2, National Bureau of Standards.

Accompanying chart provides a sufficiently precise graphic method of determining "conductor loading" values, except for certain conductors when used in the light-loading district. "However, in determining permissible sags and tensions in such a district, the variations found between the values obtained by this chart and values computed in accordance with rule 251, part 2. NESC, are of little importance, since one of the unloaded tension limits of rule 261, F, 4 will control, except for unusually long spans."

×

NOTE: This chart published by U. S. Department of Commerce, National Bureau of Standards and designated as Miscellaneous Publication M176, chart 1A and 1B, in enlarged form 14x22 in. (price 25 cents), and the Handbook H39 (price 75 cents) are obtainable from Superintendent of Documents, Washington (25), D. C.

A similar chart (B) that gives greater accuracy for small values of V (0.01-1.0), of W (0.01-0.5) and of T (0.1-1.4), is on the reverse side of the enlarged chart (1A).



Instructions

To use this chart, connect V and W with straight edge and read T.

HOW LINE MATERIAL
SOLDERLESS
Electrical
Connectors
KYLE DESIGNED
AND
MANUFACTURED
Give Better Electrical Connections
Made From High Copper
Content Alloys for
HIGH CONDUCTIVITY
High Pressure
Between Wires for
TIGHTEST CONTACT
Machine Cut Threads
on Body and Nut for
HIGH STRENGTH FACTOR
IMMEDIATE DELIVERIES ON TYPES AND SIZES FOR EVERY REQUIREMENT
MADE BY KYLE CORPORATION
SOUTH MILWAUKEE
WISCONSIN
KYLE Circuit Products are
Designed and Manufactured for
LINE MATERIAL COMPANY

How to Protect Metering Equipment

V—Residential Meter Protection

By R. F. QUINN*

Central Station Engineering Division, General Electric Co., Schenectady, N. Y.

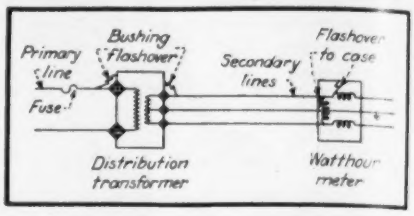
Protection of a residential meter starts with adequate protection of the distribution transformer supplying the service. This will prevent primary voltage from being imposed on the secondary and thus protect the meter from this hazard. However, in suburban or rural areas where secondary lines are longer and more exposed, lightning may be imposed directly on the secondary lines and thus give trouble by causing flashover of transformer secondary bushings and flashover or potential coil damage to the meter.

There are three broad classifications of possible types of meter damage due to lightning. The first of these is insulation flashover or puncture due to lightning overvoltage. Suitable meter protectors connected in the circuit guard against such damage. This protector is installed by connecting one line lead to each ungrounded line conductor ahead of the meter and the ground lead to the grounded neutral conductor. This places the protector in direct shunt relation to the meter insulation to ground.

One particular type of meter protector has a sparkover of approximately 1.6 kv. and an IR drop of 1.3 kv. at 1,500 amp., and at 200 amp. the IR drop is less than 3-kv. crest. This results in a liberal margin of protection to a meter impulse strength of 8 kv. This protector can be installed either indoors or outdoors.

A second type of lightning failure is mechanical damage to the meter. This damage, such as a bent disk, is caused by high lightning discharge currents in the secondary line conductors which result in excessive mechanical forces within the meter. By installing a meter protector from line to a low resistance ground ahead of the meter, a large part of the discharge current may be diverted and the high mechanical forces are minimized.

The third type of damage is that of drag magnet demagnetization. This is caused by excessive lightning discharge currents flowing toward ground near the meter magnet. A great stride toward eliminating this type of damage has been the development and use of alnico magnets.

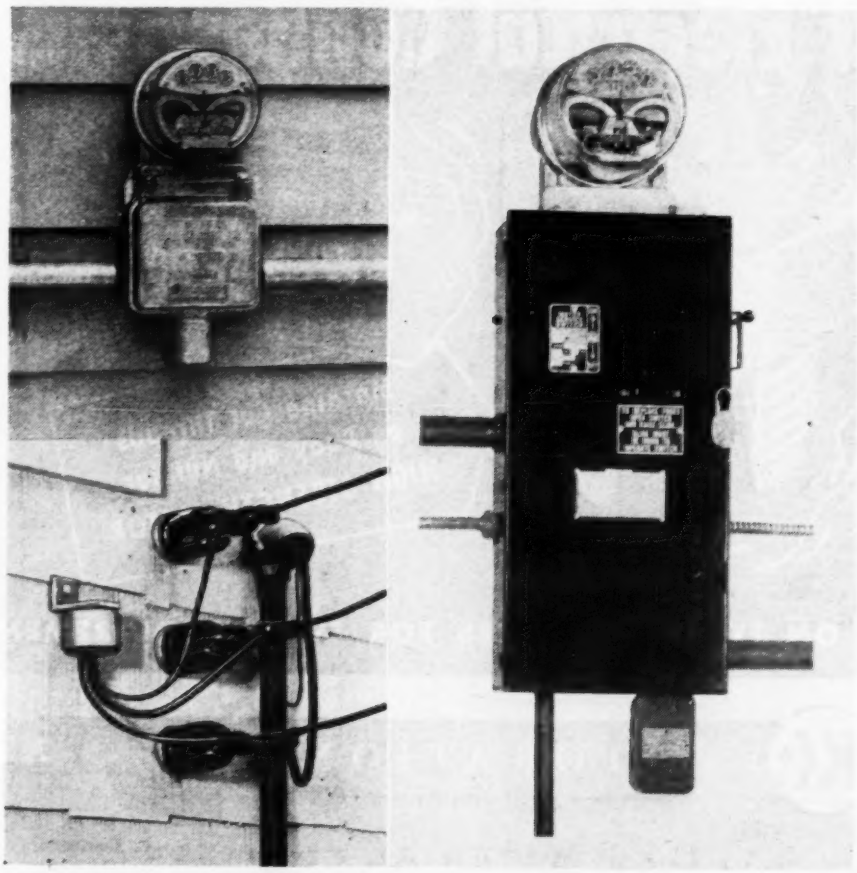


METER is subjected not only to lightning voltage but to system primary voltage when a lightning impulse causes a flashover to the tank of the unprotected or inadequately protected transformer. This raises the potential of the tank so that arc-over may occur to the secondary conductors as shown

However, there are many meters in service without this type of magnet, which under high lightning discharge currents may show some demagnetization. Any arrangement of conductors that will either remove the neutral conductor from the vicinity of the meter, or provide a good ground connection for the neutral conductor ahead of the meter will reduce the tendency of demagnetization since the amount of current passing to ground near the meter will be reduced.

Records should be kept so that troublesome areas will be known. These records will show whether it would be economical to take steps to prevent meter troubles from lightning in these particular areas.

* Concluding article in this series which began in ELECTRICAL WORLD, January 20, page 133.



TWO MOUNTINGS OF THE PROTECTOR on indoor and outdoor meter boxes. Also an installation at the junction of the secondary lines and the service conduit

Cable "Luffing Out" Time Cut 50 Percent

Come-along used by the Philadelphia Electric Co. cuts the cable withdrawal time in half. Because of this feature, although it was developed as a temporary expedient to overcome the hemp-sling shortage, it will continue in use after the war.

Details are shown in the accompanying illustration. Grip is obtained by the slight up-pull on the rope caus-

World War I Memorial

Give them a memorial that lives

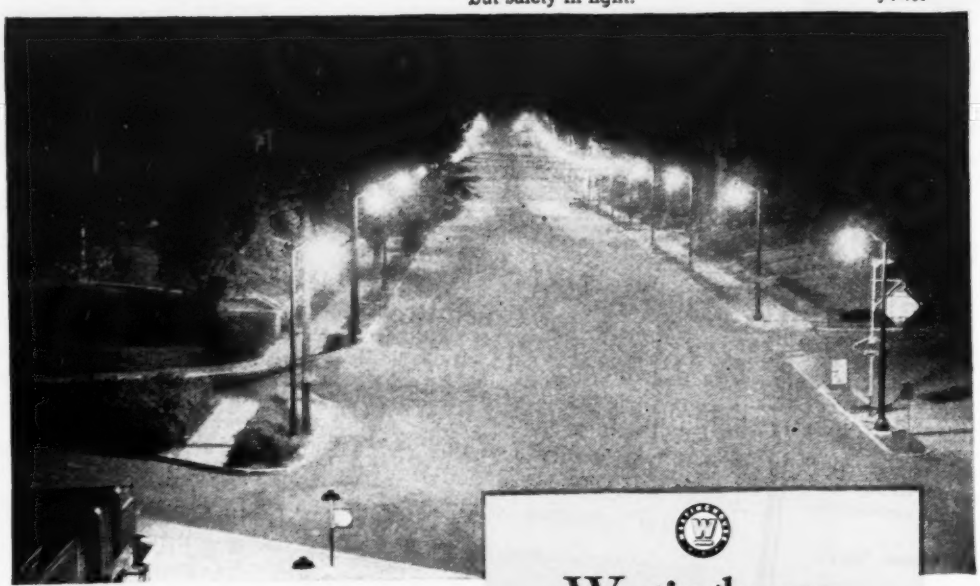
They fight for an ideal—and the ideal revolves around their own home towns, and the future of their families. This ideal can best be perpetuated by a memorial that benefits these families, and typifies a practical peace.

A memorial that will aid the future of their families day after day, is a Public Safety Lighting System. It will provide greater individual freedom, safety after dark, safety from traffic accidents, burglaries, robberies and property damage.

This memorial will also be a reminder of the administration that abolishes darkness . . . the darkness which encourages delinquency, breeds crime, complicates police work and undermines public confidence.

Many cities are today studying this problem with the aid of Westinghouse street lighting engineers who have years of experience in this work. These engineers are equipped with information and data from many cities and towns, much of which applies to your own problem.

The story of good Public Safety Lighting is graphically told in a new Westinghouse book that contains facts helpful to civic leaders. Ask your electric power company for your free copy of "Target for Tonight" or write Westinghouse Electric & Manufacturing Company, P. O. Box 868, Pittsburgh 30, Pa. There's danger in darkness . . . but safety in light. J-04031



For World War II—a Public Safety Lighting System will memorialize better living . . . safety for the individual . . . the end of brutalities that flourish in the darkness. It will symbolize an enlightened world, an end to blackouts forever.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

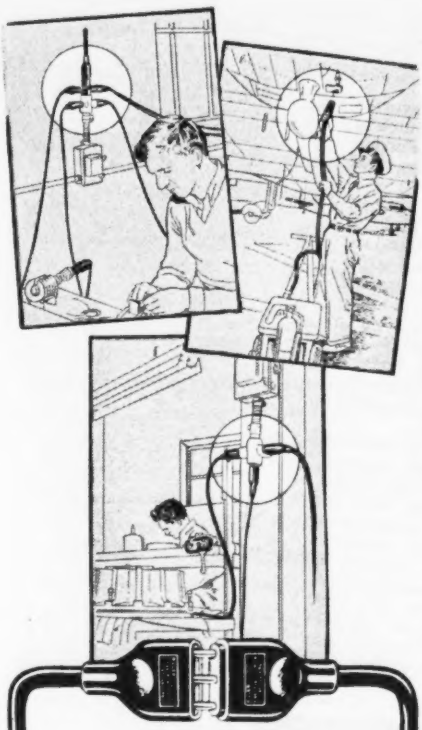
Public Safety Lighting

This advertisement appears in American City for February, 1945

Read this suggestion . . . as presented to civic officials through the advertisement reprinted here.

We suggest that you make sure civic officials and citizens' civic organizations have complete data on the benefits of good street lighting. J-04026

A PROJECT CLOSE TO THE HEART OF YOUR COMMUNITY



MINES

Water-Seal Cable Connectors Transmit Power to the Job Safely and Efficiently

Mines Cable Connectors are molded right on the rubber cable so that the connector becomes a part of the cable itself. The spring pressure female contact and the patented water-seal assure you a positive connection with the male connector for efficient power supply to any machine under all plant conditions

For Any Portable Power Supply

Many types and sizes of Connectors have been developed, making them adaptable to almost any industrial application where power is transmitted by portable cable. Standard connectors are rated for loads to 600 volts.

Our engineers will gladly work with you in solving portable cable applications on capacities up to 5000 volts and 325 amps.

For efficient, safe, flexible power transmission by cable, use Mines Connectors — "The Connector with the Water-Seal."

WRITE FOR BULLETIN MC-106, *showing many successful applications of Mines Connectors throughout industry.*

MINES EQUIPMENT COMPANY

4235 Clayton Road
St. Louis 10, Missouri

ing the saddles to squeeze the cable. The area of the saddle is large enough to prevent any injury to the sheath.

To make a hitch the top half of the split saddle is placed on the cable, the lower half under the cable and the

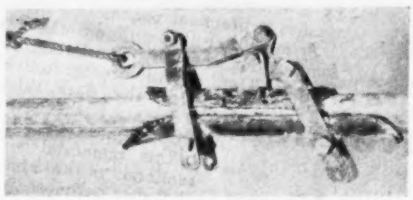


Photo by R. M. Hoot

COME-ALONG grips cable between two split saddles is released easily

two bolts inserted as shown. Tension on the rope draws the two saddle halves together grasping the cable. The greater the tension is on the ring, the greater the saddle grip on the cable.

To place the come-along for the next draw the workman merely slacks off on the rope, presses down on the ring and slides it along the cable to the point at which the grip is to be reapplied. The ease and rapidity of breaking the hold, positioning the come-along and applying the next hold is the feature that makes the time saving possible.

Painting Tool for Coating Wire

A painting tool which permits aerial telephone drop wires to be coated with asphalt without lowering them or taking them out of service has been developed and is used by several operating companies associated with the American Telephone & Telegraph Co. By the coating procedure life of the wire is estimated to be increased two to three years.

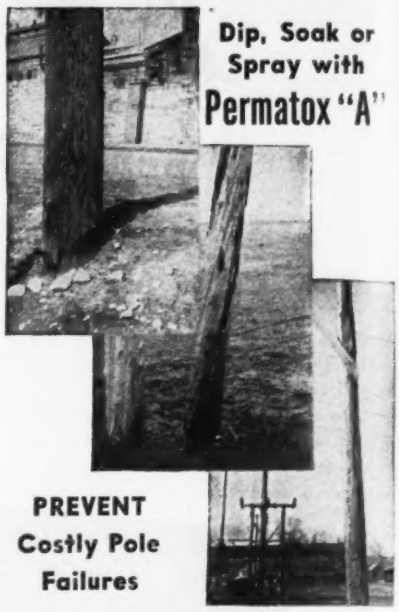
FIG. 1—Painting tool coats asphalt on wire. Coated section of wire in foreground, weathered section beyond

The wire painter consists of a rect-

PERMATOX "A"

(A Straight Toxic Wood Preservative)

Reclaim OLD POLES Preserve NEW POLES



Dip, Soak or Spray with Permatox "A"

PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole now in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, crossarms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents
*Manufactured by The Dow Chemical Company

Write for Bulletin—Dept. E.

A. D. CHAPMAN & COMPANY, INC.

333 N. Michigan Ave., Dept. "E" Chicago 1, Ill.

Atlanta Memphis Portland
New Orleans New York

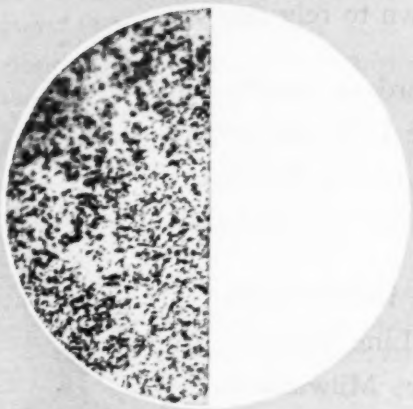
ONE OF THE MANY DOW CHEMICALS USED BY AMERICAN INDUSTRY

they quit painting with mold

Mold has a special appetite for paint. It likes practically all kinds, but its favorites are water soluble and emulsion types because of their high protein content.

When paint manufacturers presented their problem, Dow technicians gladly accepted the challenge. For they are probably the No. 1 enemy of mold, having fought it zealously for years. The "half and half" circle at the right proves how well Dow research men succeeded in combating mold in paint by mixing Dowicide in it during the manufacturing process. After 30 days' exposure in a humidity chamber, the Dowicide-treated portion remained free of mold. The untreated section on the left of the circle was dark with mold. Paint fortified with Dowicide resists mold even under conditions of dampness such as may prevail in breweries, canneries, dairies, textile and paper mills. The result is better light reflection, less loss from frequent renovations and shutdowns.

Today, there is a total of seventeen related Dowicide products. Each is designed for a special job but all are ready to help you with any mold problem that may exist under conditions special to your industry. Call on Dow to help you combat destructive, expensive mold attacks.



Dowicide

Germicides and fungicides

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

More and More He Relies on L-M Pole Line Hardware

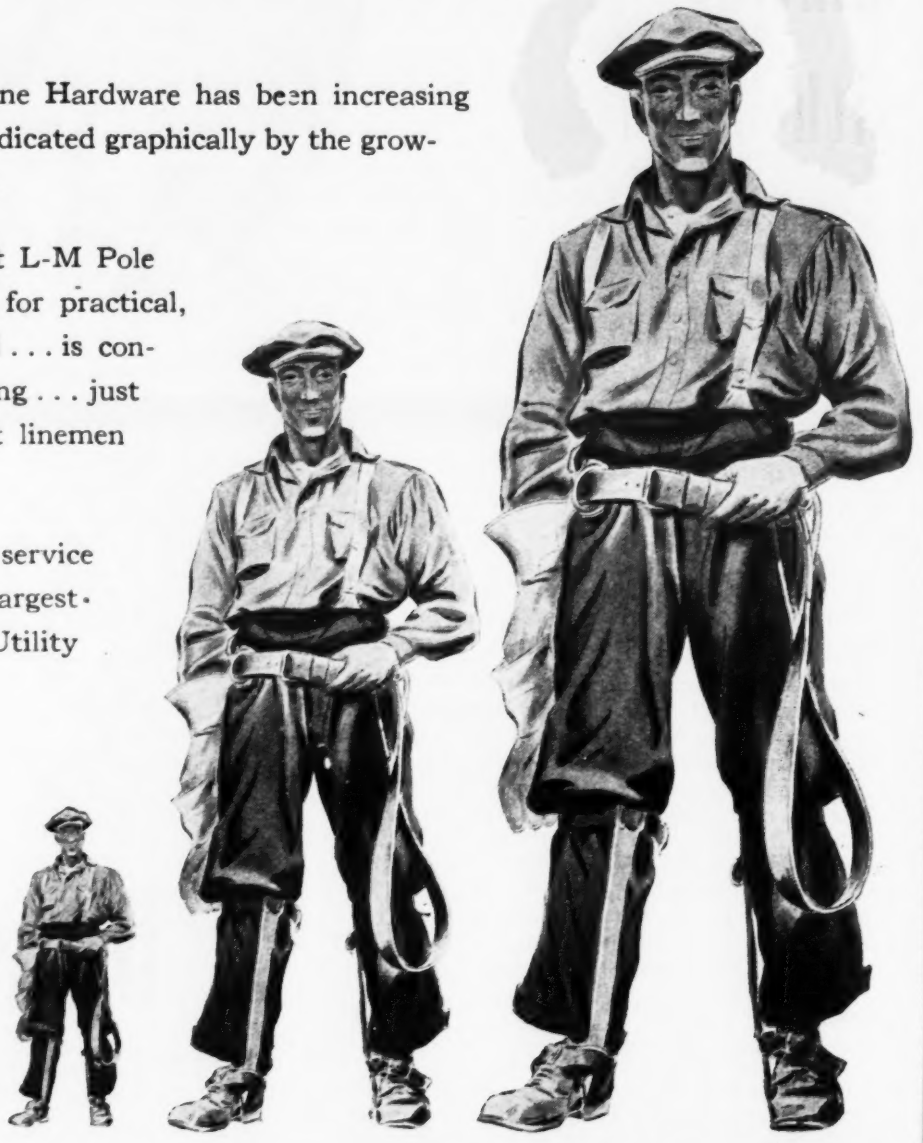
Preference for L-M Pole Line Hardware has been increasing rapidly for many years, as indicated graphically by the growing size of the L-M lineman.

This is due to the fact that L-M Pole Line Hardware is designed for practical, long life service in the field . . . is conveniently packed for handling . . . just the kind of equipment that linemen have grown to rely on.

This record of quality and service has made L-M one of the largest suppliers of the Electrical Utility Industry for over 30 years.

For full information write to Line Material Company, Milwaukee, Wisconsin.

★



1920 1930 1940

LM

LINE MATERIAL

POLE LINE HARDWARE

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

How LM Round Wound Construction ended loss-juggling compromises

For years transformer design was a series of compromises. Cutting one loss increased another; cutting original cost raised operating cost; lower voltage drop meant higher exciting current or higher cost.

Careful study convinced many engineers that copper loss should be reduced to gain lower voltage drop, in order to deliver more uniform voltage to the customer. This, however, increased the flux density and core loss, and resulted in higher exciting current. Better regulation was gained, but only at higher operating costs.

Core efficiency could be raised with a wound core; but cutting or unwinding the core after annealing to put on the coils opened up air gaps, disturbed the flux, and lost much of what the wound core gained.

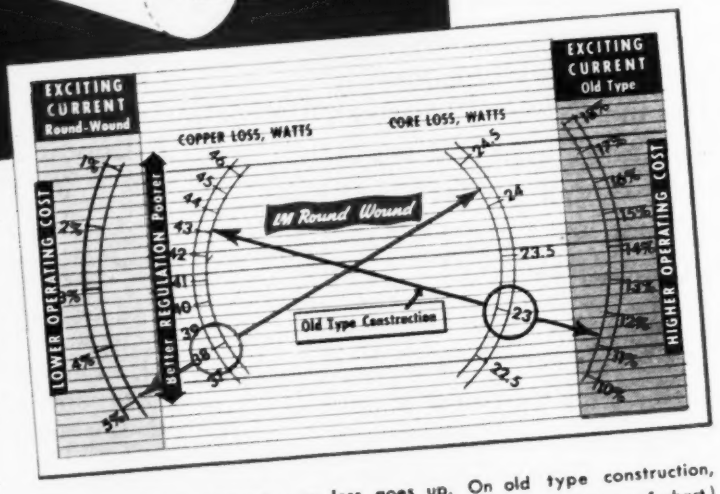
It was not until Round-Wound construction was developed by L-M engineers, with its method of winding round coils right onto the core, that the benefits of this ideal core were realized.

This method left the core undisturbed after annealing—practically free from air gaps. It was thus possible to reduce turns for lower copper loss, and still make a transformer with exciting current as much as 50% lower, and with improved regulation at *all* power factors.

Other desirable results—uniformly higher impulse strength, greater short-time overload capacity—are inherent in the method of winding, the long, round coils, generous, undisturbed insulation, highly efficient cooling.

The result: a transformer that lowers operating and maintenance costs; gives extra years of service; and delivers better service to the customer and more profit to the operator.

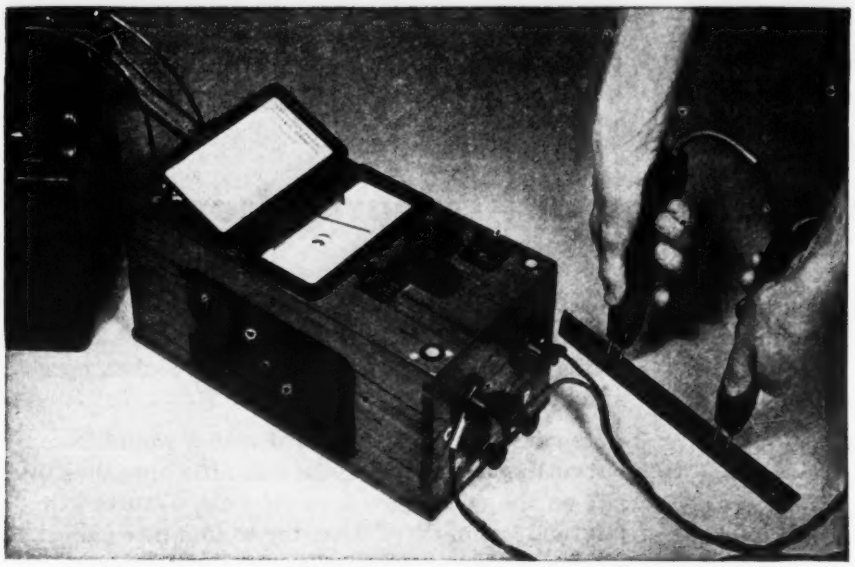
Round-Wound construction provides practically ideal magnetic circuit; long, round coils, wound at even tension and not forced into square shape; generous undisturbed insulation; large cooling surfaces, plus cooling passages wound into coils and between coils and core.



As copper loss is lowered, core loss goes up. On old type construction, exciting current was raised beyond desirable limits. (Grey section of chart.) The blue section shows how Round-Wound construction made it possible to reduce copper loss still further; and still have far lower exciting current.

L-M Round-Wound Transformers are available in 1½ to 25 Kva, 2400 to 7620 volts. Meet latest EEI-NEMA standards. For details ask L-M Field Engineer; or call or write L-M branch or Line Material Company, Milwaukee 1, Wisconsin.

LM
LINE MATERIAL
TRANSFORMERS
L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters
Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment



Get the "Low-down" on Circuit Breaker Performance

"DUCTER" LOW RESISTANCE OHMMETER

measures current-carrying ability of circuit breakers and switches down to .000001 ohm

Built to "stand the gaff" of field use . . . reads directly by pointer deflection . . . so accurate and reliable that your laboratory can readily give O. K. . . . SUCH is the Ducter Ohmmeter, a rugged "Megger" type instrument that is now finding important uses in circuit breaker maintenance and for testing other low resistances that today *must* carry their rated loads.

The Ducter operates from a storage battery, and by applying test leads, one can actually *see at a glance* the condition of a vital part of a circuit breaker, switch or joint—namely—its contact resistance. The Ducter Ohmmeter does for measuring conductor resistance what "Megger" Instruments do for testing insulation resistance.

Write for illustrated descriptive Bulletin 1635-W.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

angular container and includes two wheels, one holds the device on the wire, the other or lower one rotates partly submerged in the paint and is equipped with a felt tread to carry the paint to the wire. At one end of the container an assembly of brushes serve to distribute the paint and remove the excess from the wire.

The painter weighs approximately 6½ lb. and is attached to a tree-pruner handle. It is put on and removed from the wire by the operator on the ground, who pushes it along the wire at the rate of about 50 ft. per min. One filling of the container is sufficient, it is reported, for 300 to 400 ft. of wire, depending on the wire's condition. One repairman engaged in coating drop wires in a particular locality can paint 50 or more per day.

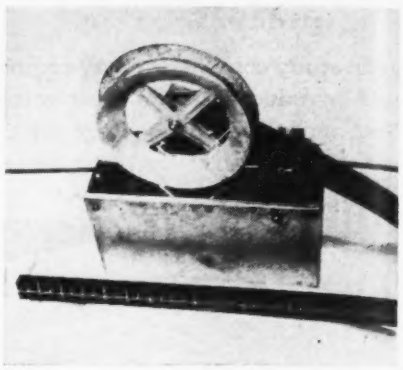


FIG. 2—Close-up view of wire painter

•

A Repair Method for Linemen's Gloves

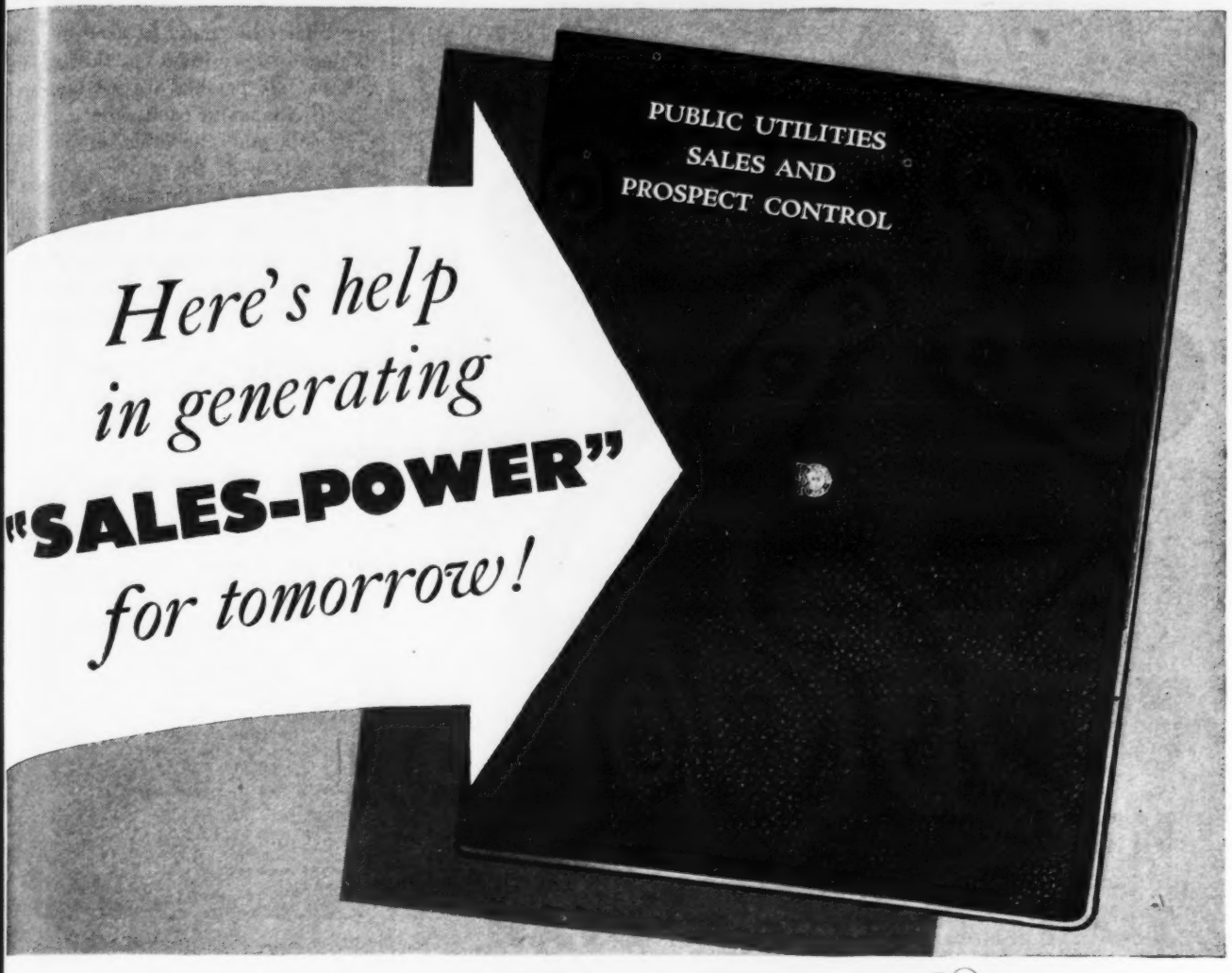
By F. F. REED

Testing Laboratory, Public Service Electric & Gas Co., Maplewood, N. J.

An inspection and repair method for linemen's rubber gloves has enabled Public Service Electric & Gas Co. to utilize a large number of gloves which would otherwise have been discarded. The value of the process is shown by the number of rubber gloves salvaged; 700 pairs of gloves were repaired in a period of 30 months.

Gloves whose condition is considered questionable are returned to the company's testing laboratory, Maplewood, New Jersey, for inspection and test. Small cuts and punctures in an area within 4 in. of the end of the cuff are repaired by the Shaler Hot Patch Method after which the glove is retested.

For the repair operation in the case of a severe abrasion or surface cut



Here's help in generating "SALES-POWER" *for tomorrow!*

• The extent to which the pent-up demand for appliances is met by utility companies, and the consequent load-building that is achieved, will depend on the force and proper application of well-rounded sales plans *conceived now.*

Many officials have told us our booklet "A Public Utility Postwar Sales Program" is proving of great value in their planning. This generous welcome has prompted us to go further, and in "Public Utility Sales and Prospect Control" we present the actual record forms required for effective control of sales activities.

Included are sample working systems, with administrative records that provide the factual data on which sound, intelligent, day-to-day control by prospect, by territory and by salesmen can be maintained most easily.

Public utility officials are invited to read this study. It is now available on special ten-day loan service from our Systems Research Data File—on personal request.

ON LOAN . . . FOR STUDY

Systems Division
Remington Rand, Inc.
Buffalo 5, N. Y.

☐ Please send me on your ten-day loan service, "Public Utilities Sales and Prospect Control."

☐ I would like to have a copy of "A Public Utility Postwar Sales Program."

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Buffalo 5, New York

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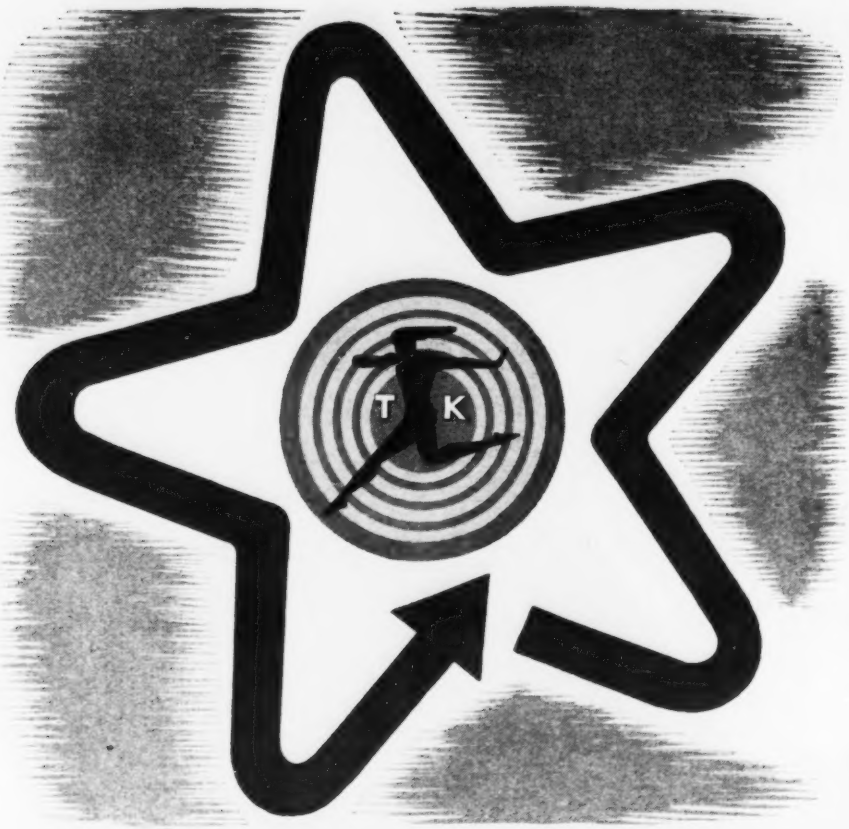
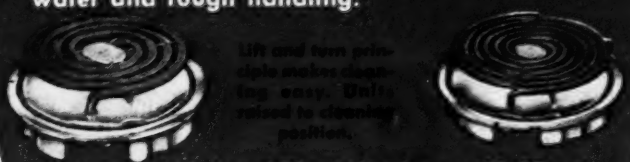


HITCH YOUR WAGON TO THE T K STAR

Tie up with a quality product now and cash in big in the years ahead. Serve your customers with TK replacement units to replace burned out or inefficient units on electric ranges. Here are the TK technical features that assure uniform high quality nickel-chromium resistance wire in perfect spiral centered in magnesium oxide. Rugged precision construction defies the extremes of heat and cold-rust-corrosion-steam, water and rough handling.



There are only 2 sizes of TK units but there are 18 different installations rings that make these units fit all makes of

Electric Ranges

TUTTLE & KIFT INC.

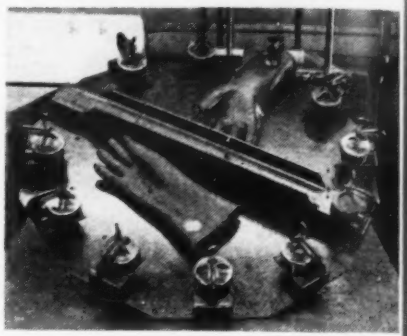
1825 NORTH MONITOR AVENUE · CHICAGO 39, ILLINOIS

MANUFACTURERS ● DOMESTIC AND INDUSTRIAL HEATING UNITS ● SWITCHES ● CONTROLS

one Shaler hot patch is used over the damaged area; for a cut through the rubber, two patches are used—placed directly opposite each other, one on the inside and the other on the outside surface of the glove.

Steps in the process are:

1. Removal of oil or dirt and roughening the surface of the glove at the cut using a carborundum stick.
2. Application of liquid compound (Commander Vulcanizing Cement, Gates Rubber Co.), on glove and on patch outerside.
3. Dry treated surfaces until "tacky."
4. Application of Shaler hot patch over cut.
5. Apply pressure to hold patch cartridge in place with clamp.



RUBBER GLOVES, sleeves and blankets are patched on this device

6. Ignite cartridge to vulcanize patch.
7. Remove metal retainer of cartridge while patch is slightly warm.

Steps 4, 5, 6, and 7, are in conjunction with a patch application machine illustrated. This device is a plate which can be rotated and has mounted on it 12 supports and patch clamps.

Before the clamp is tightened a 3-in. diameter by ¼-in. thick metal disk or anvil is placed on the under surface of the glove. The disk face which is placed against the glove is concave. This curvature tends to flatten the patch and prevents curling at the edges. The disk is used only on flat surfaces being vulcanized.

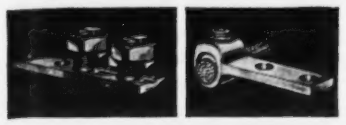
After the gloves have been repaired, they are tested at 10 kv. for 3 minutes, are mated, and each pair is numbered and packed before being released for use in the field.

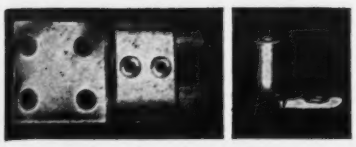
Rubber blankets and linemen's sleeves are similarly repaired. Boots are patched by the same method and made available for other than electrical use.

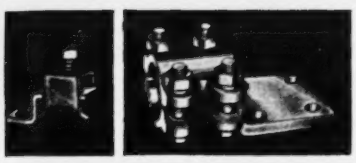
"To get the **RIGHT** lug at every point—

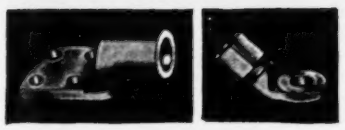
—select your terminals from the **COMPLETE** line"

Look in the Penn-Union Catalog—all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:







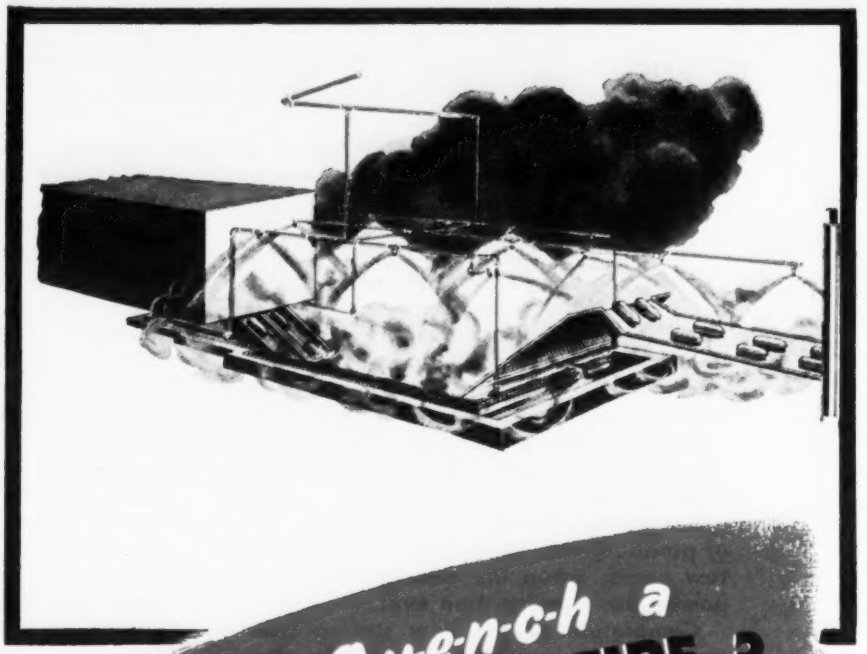


You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

Penn-Union fittings are preferred because every one is mechanically and electrically *dependable*. They are the first choice of leading utilities, industrials, electrical manufacturers, contractors. *Write for the Penn-Union Catalog.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings



How Q-u-e-n-c-h a QUENCH TANK FIRE?

Automatic
FIRE-FOG
★ IT BLANKETS ★ IT ISOLATES ★ IT QUENCHES

● Time was, and not so long ago, when a blazing oil quench tank was no easy thing to subdue—and the resulting loss in money, production hours and output was prodigious.

Then came FIRE-FOG and a new era of fire protection was ushered in.

This system of fire quenching is seemingly miraculous in its ability to deliver a quick, "knock-out" blow to flammable liquid fires. In only a few seconds of time a blazing tank is completely extinguished *and the action is entirely automatic.*

Here's how a FIRE-FOG system works: FIRE-FOG nozzles are strategically placed to cover the fire hazard areas. No sooner does fire break out than a mist-fine spray of water attacks the burning area. Action is swift, sure and automatic. The flames are beaten down; an enveloping blanket of spray causes oxygen starvation and smothers the blaze; almost immediately the fire is extinguished.

Little wonder American industry has been quick to recognize the fire-fighting potency of FIRE-FOG—*it blankets—it isolates—it quenches.*

"Automatic"

"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Write for complete information—we'll furnish it cheerfully.

SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO . . . OFFICES IN 31 CITIES

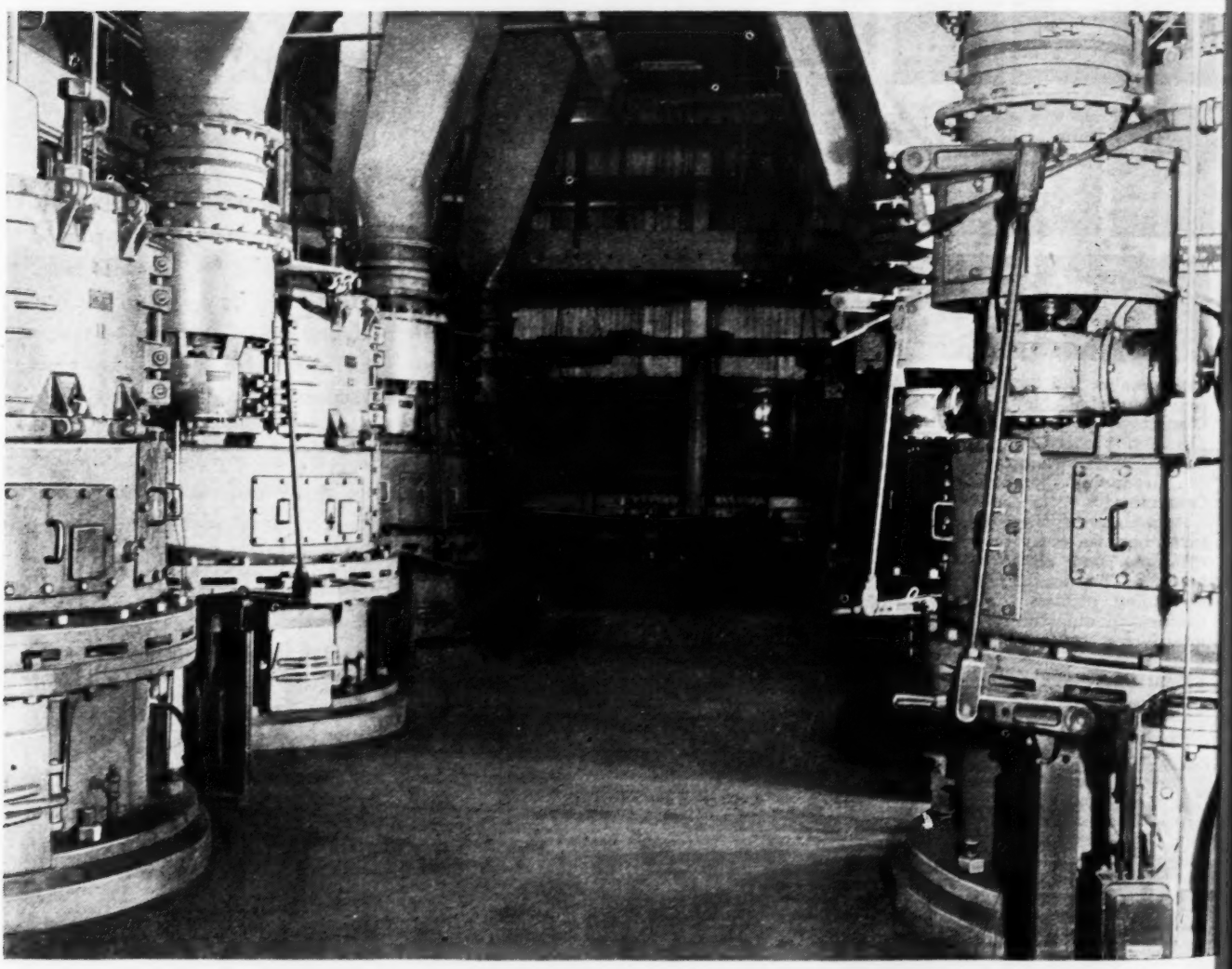
From DREAM to STEAM

25-Year Vision of Ohio Electrical Pioneer Became Reality in New R. E. Burger Station

On January 21, 1944, The Ohio Public Service Company officially started up and dedicated its new modern generating station at Dilles Bottom, Ohio, on the Ohio River. It was a momentous occasion for officials and engineers of OPS. A dream had come true. More than 20 years of foresight and planning had at last become a reality. No less an achievement was the excellent service rendered by the existing plants on the system during this long period of planning, and especially during the past few years, when the demand for electric power was greater than ever.

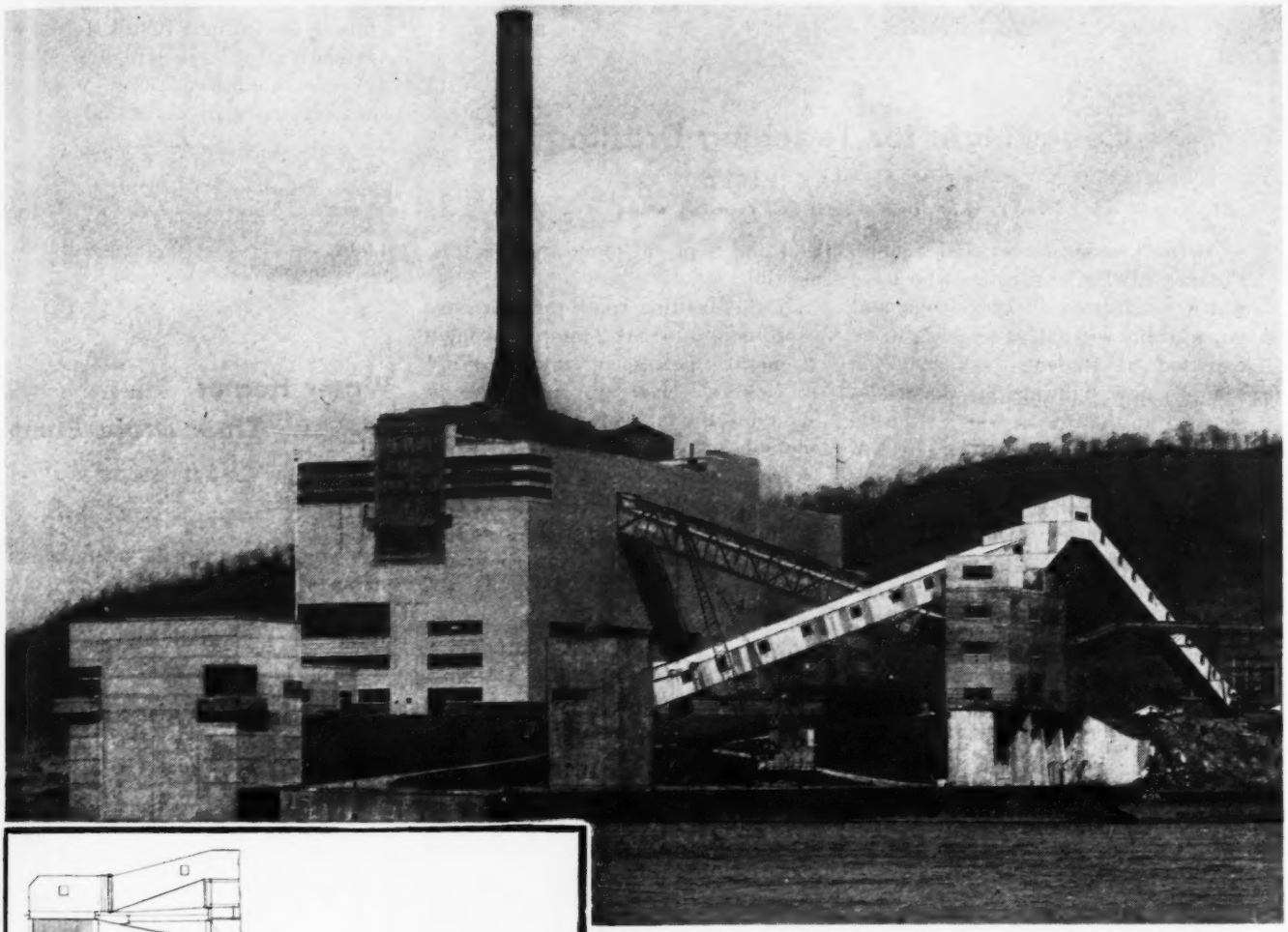
Completion of the new station was a particularly significant climax for R. E. Burger, President of Cities Service Power & Light Company. Pioneering the idea of building a central station on the site, he saw his vision and judgment vindicated as the steam throttle was opened for the first time and the 62,500-Kw turbo-generator began to hum in the plant appropriately named in his honor. It was a proud day, too, for the men who had surmounted a long chain of wartime obstacles in constructing the plant that, according to OPS President, T. O. Kennedy, "guarantees ample electricity for all war manufacturing needs in our territory. After the war, it insures all persons on our Company's lines an abundance of power enabling them to make full use of the many electrical servants—the labor-saving devices they will be able to obtain".

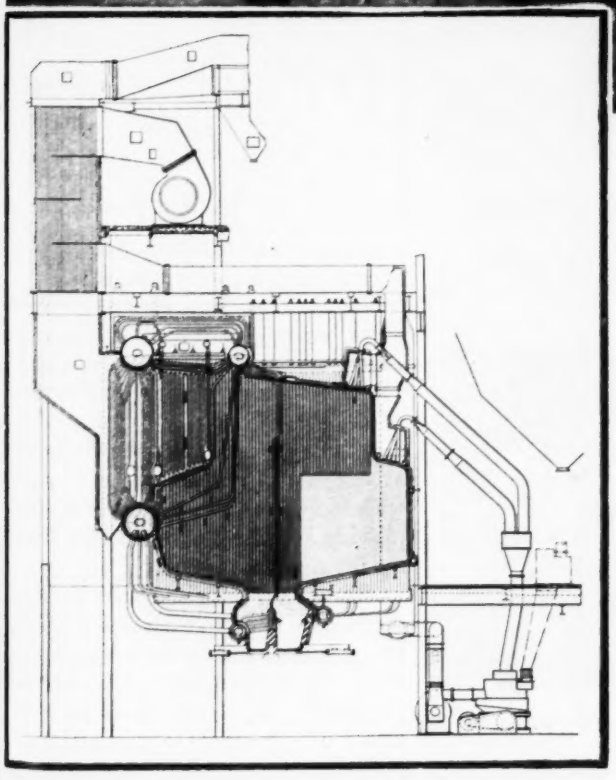
Babcock & Wilcox, in saluting this OPS achievement, is proud to have had a part in it by furnishing the power behind the power — the steam-generating equipment.



Three B&W Type E Pulverizers serve each of the Stirling Boilers.

. . . a 500 Million KWH. Success Story





Two Stirling Boilers supply the steam needed at R. E. Burger Station to generate an annual power output of 500 million kwh. Each boiler has a capacity of 350,000 lb. of steam per hr. The two boilers supply the steam needed by the 62,500 kw. turbo-generator.

BABCOCK & WILCOX

THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET, NEW YORK 6, N.Y.

G - 2701

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Better Light for Teaching Drafting

By T. D. WAKEFIELD
The F. W. Wakefield Brass Co., Vermilion, Ohio

At the Pontiac Vocational School, Pontiac, Mich., instructors who have watched hundreds of classes come and go, who know what progress is to be expected of students, say that the school's new lighting has materially speeded up the rate at which students assimilate their lessons. The physical strain of learning has been reduced. And for the teacher the new lighting has brought easier work in the form of less eye strain.

This vocational school has been graduating hundreds of trained draftsmen, machinists, welders, printers, aircraft mechanics, and pattern makers. Its pupils have had a big part in winning the battle of production and many of them are overseas, as well.

In the drafting room there are five continuous rows of 2-lamp Wakefield "General" fluorescent fixtures on 7½ ft. centers. They are run on a diagonal to the tables for better shadow control.

The installation was engineered by the Consumers Power Co. The room is 26 ft. by 40 ft. and has a ceiling of 12 ft. The fixtures are mounted 10 ft. above the floor. The reflection value of walls and ceiling is approximately 70 percent. There are 19 fixtures each containing two 100-watt, 5-ft. tubes and the light intensity on the working level is 52 f.c.

STUDENTS FIND LEARNING EASIER, and so do instructors find teaching, in this school drafting room which is lighted to 52 foot-candles

Volume Ratios of Appliance Sales

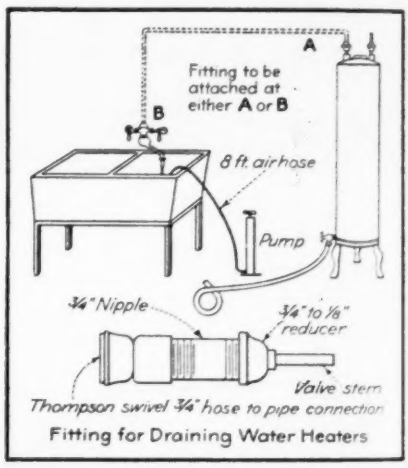
Indicative of the relative importance of the channels by which electrical appliances will reach the user when the trade revives after the war, is a statement of ratios of appliance sales in 1941 presented recently in a talk to the Indiana Retail Hardware Association by T. J. Newcomb, Westinghouse appliance sales manager. The breakdown by outlets is:

Electrical Appliance and Radio Stores	39%
Electric Utilities	20
Department Stores	17
Furniture	12
Hardware	8
Miscellaneous	4
	100%

Water Heater Tank Drain Pump

By WAYNE BROCK
Pacific Gas & Electric Co., Sacramento, Calif.

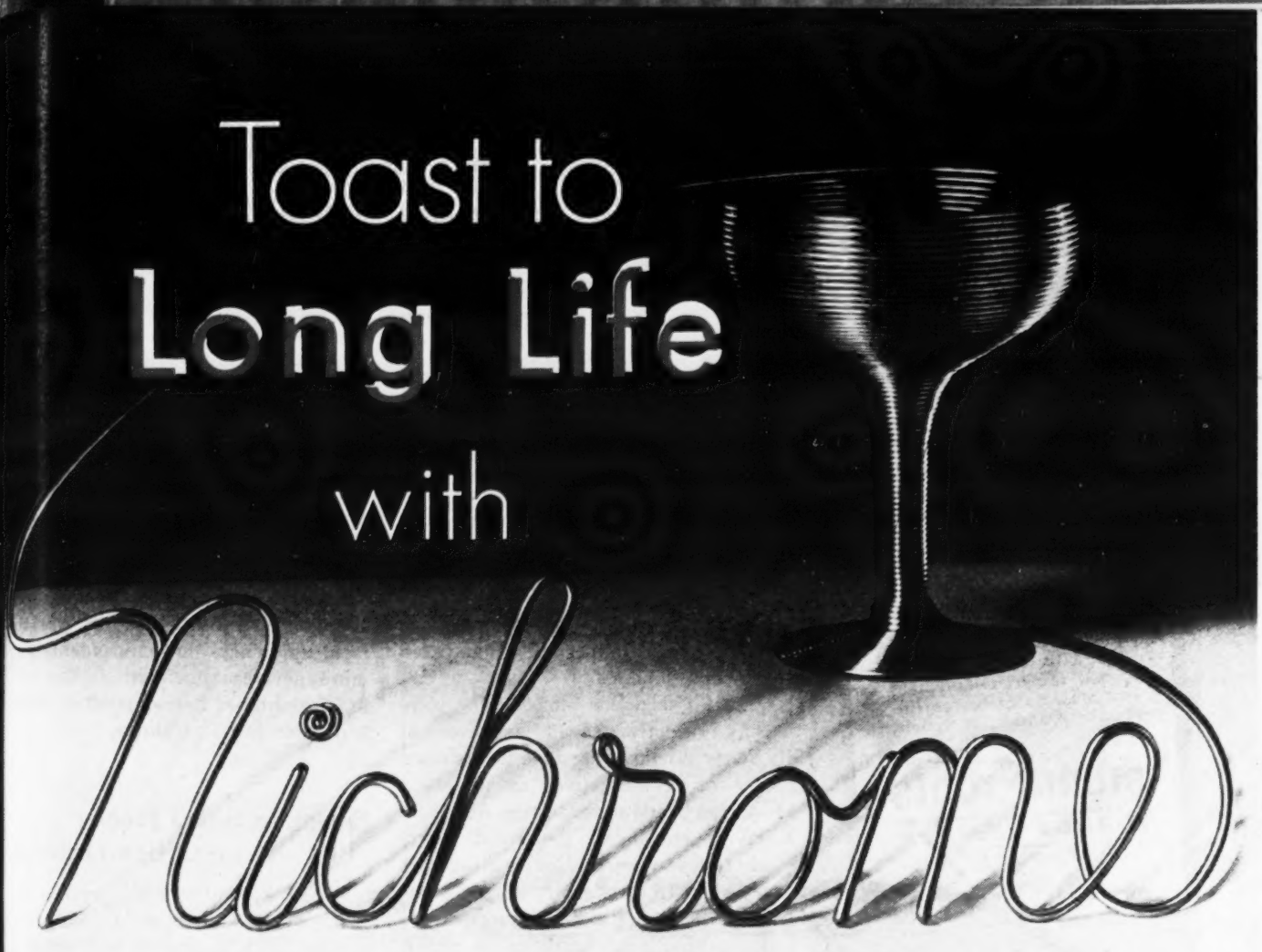
A simple method of using a tire pump to speed draining of hot water tanks has been in use for some time in the Sacramento division of Pacific



TIRE PUMP provides air pressure on hot water line to speed draining of hot water tanks when required for servicing

Gas & Electric Co. As shown by the accompanying sketch, a tire pump with long hose and fitting is used to provide air pressure on the hot water line of the tank.

This device eliminates the use of a centrifugal pump employed by some service men and has the advantage of much lower equipment cost and easy portability. By applying air pressure, tanks are drained in 15 min. that



made Only by Driver-Harris

Electrical resistance and heating elements wound with Nichrome* live a longer life of satisfactory service because of ***perfected heat and corrosion resistance properties.***

Indeed — Nichrome* is the universally accepted standard of quality in dependable resistance alloys, for this exclusive Driver-Harris nickel-chromium product enjoys an enviable record with leading manufacturers of electrical equipment throughout the world.

Product of unceasing Driver-Harris research Nichrome* is more than a combination of metals. It is the result of 45 years of specialized knowledge and exclusive D-H methods, formulas and quality controls in the production of the ***world's foremost resistance alloy.***

Nichrome*. . . is a toast to longer life and improved performance in your post-war products, so specify it and other D-H resistance alloys when buying resistors and heating elements.

*Trade Mark Reg. U.S. Pat. Off.

D H
SPECIAL PURPOSE ALLOYS SINCE 1890

Driver-Harris
COMPANY

HARRISON, NEW JERSEY

BRANCHES: CHICAGO • DETROIT • CLEVELAND • LOS ANGELES • SAN FRANCISCO • SEATTLE

STURD-E GUARDED
PIKE POLE
• The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.
The spike is forged from best quality steel, heat treated and tempered for long life. Handles are select fir—sanded and lacquered—lengths regularly furnished ten to twenty feet. For maximum service life, economy, and value, specify
STURD E TOOLS
a TRUE TEMPER PRODUCT
Automatic Tubular Pike Pole guard is shown in the phantom view above. Extremely simple in operation, it gives positive protection to the point of the pike.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

might require 1 to 2 hr. to drain by gravity. Moreover, many cases are encountered where tanks cannot be drained at all by gravity.

•

Promotes Adequacy of Farm Wiring

By FRED SCHROEDER,
Monongahela West Penn Public Service Co.
Fairmont, W. Va.

Anticipating the connection of many new farm customers when availability of necessary materials will allow, the Monongahela West Penn Public Service Co. is seeking to assure that the premises of these customers are adequately wired, or at least are furnished with a service entrance large enough to permit unhampered growth of load.

To forward this purpose, the company recently staged a series of "Better Wiring" meetings for its rural service representatives in its seven division headquarters cities. Adequate service entrances, the rural representatives were told, are absolutely necessary to satisfactory wiring plans for farm homes and buildings. Once the proper size entrance is determined, the farmer can go on and, with guidance, install as much wiring to meet his needs as he feels he can afford. Later, as he decides to use electricity more extensively and in additional ways, he can add to his wiring according to a plan already laid out as best suited to his particular case.

For making plans of farm wiring installations, representatives carry a book of forms of "Wiring Recommendations" (see illustration). Filled out, the form is a really comprehensive specification of wiring requirements of a farm home and buildings which the farmer can use in negotiation with a contractor. A carbon copy is retained by the representative for his record and reference.

On the front and back and inside covers of the book of forms are tabulated data and other pertinent information useful to the representative in talking to the farmer and in making out the form—wattages of appliances, calculation of feeder sizes, average operating costs of various farm appliances and equipments and minimum recommendations for wiring farmhouse, barns, poultry house and other farm buildings.

•

Effective Sales Piece on Office Lighting

"Work behind schedule, errors discovered too late, mistakes in filing, workers with headaches and strained eyes—these problems and others which reduce employee efficiency may be solved or at least helped by providing better seeing conditions in the office. Better seeing conditions may automatically suggest a new lighting system and good lighting does help

L & P-166-12½M-11-44

WIRING RECOMMENDATIONS

No. .....

For: ..... Ext. No. .....

DWELLING

LOCATION	Ltg. Outlet Cir.	Ltg. Outlet Wall	Switches SP	Switches 3 W	Con Out. Dup.	
Entrances						
Porches						
Halls						
Living Room						
Dining Room						
Kitchen						
Pantry						
Basement						
Bath						
Bed Room						
Grounds						
Totals						

Dwelling:
S. E. (Feeder) ..... Wire ..... Amp ..... AWG
Circuits:
..... : ..... Wire, No. ....., 15 amp.
..... : ..... Wire, No. ....., 20 amp.
..... : ..... Wire, No. ....., 35 amp.
..... : ..... Wire, No. ....., ... amp.

OTHER FARM BUILDINGS

BUILDINGS	Ltg. Out. Cir.	Ltg. Out. O.D.	Switches SP	Switches 3W	Power Outlets Dup.	Power Outlets Meter	Power Outlets Misc.	Serv. Entr. Wires	Serv. Entr. Amps.
Totals									

OUTDOOR FEEDERS

FROM	TO	W. P. WIRES No. AWG	LENGTH Ft.

MAIN ENTRANCE (Check with Monongahela System "Brown Book.")

Entrance Location .....
..... Wires, No. ..... AWG 115/230V
OD Meter Box Location .....
Main Switch: Location .....
Size ..... Wire ..... Amps

MONONGAHELA WEST PENN PUBLIC SERVICE COMPANY

Prepared by: ..... Date .....
(See Reverse Side for Further Details)

FORM FOR RECOMMENDING adequate farm wiring

Tape on your hands?

....Not IF IT'S Jenkins!

BECAUSE OF CONTROLLED processing, Jenkins Gold Seal Tape never sticks to your hands. It sticks to the job, however . . . like a leech. What's more, it doesn't dry out, peel, or ravel. In addition, it's cellophane-wrapped—and then boxed—therefore always factory-fresh. Made by the makers of Jenkins Diamond Seal Friction and Rubber Tapes, which meet A S T M and Federal specifications . . . Jenkins Bros., Rubber Division, 80 White Street, New York 13, N. Y.

JENKINS

Gold Seal Tape

FRICTION ... RUBBER

4360 TYPES OF EVERLASTING FASTENINGS *in Stock*

BECAUSE of these large and varied stocks, Harper is known as "Headquarters for Everlasting Fastenings" . . . "Your Logical Source" of non-ferrous and stainless bolt and nut products.

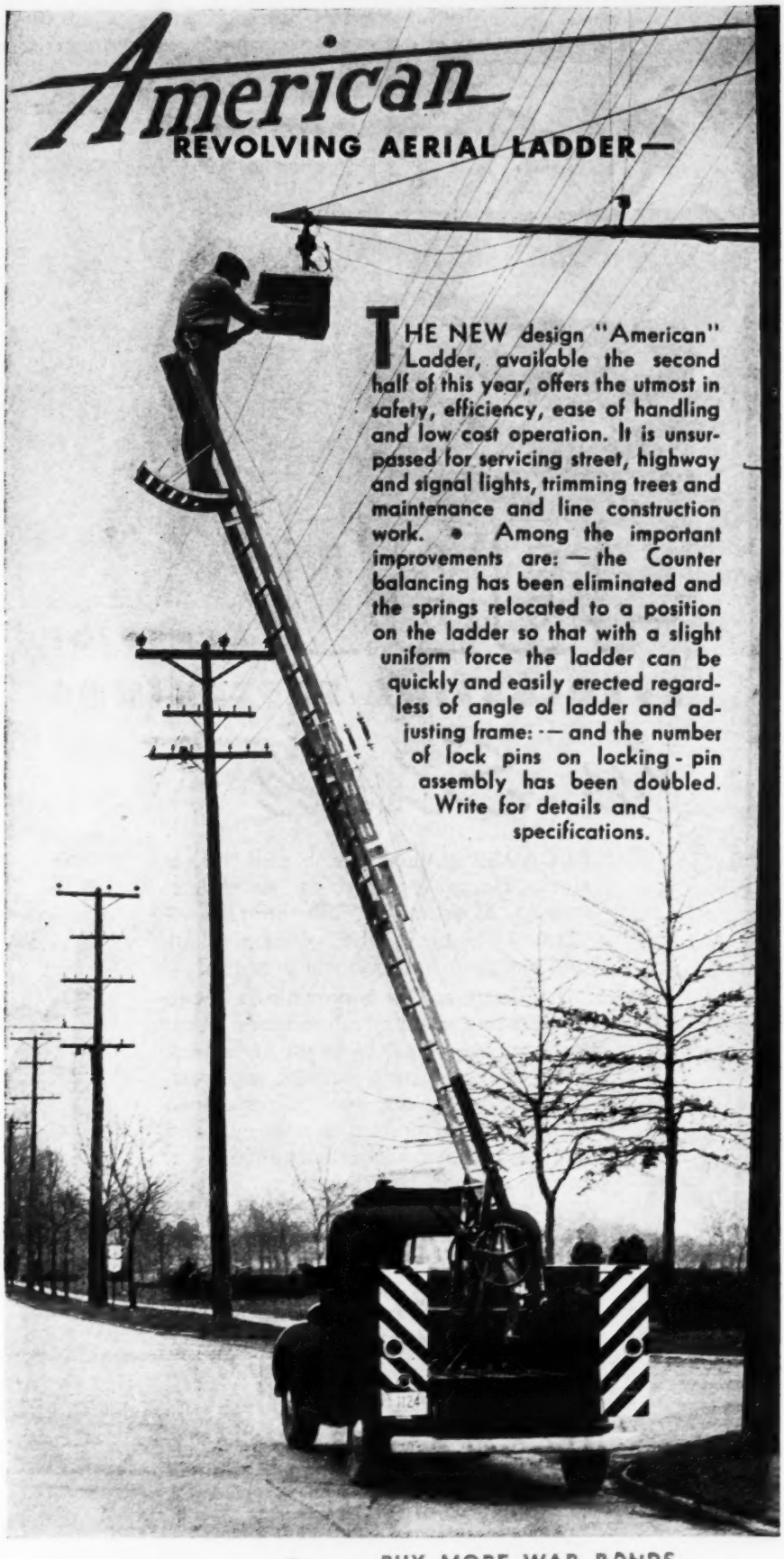
At Harpers the buyer finds three unique and distinct advantages. First, large stocks of all types of fastenings such as bolts, nuts, screws, washers, rivets and specials; second, fastenings in all the commercial non-ferrous and stainless alloys except aluminum, e.g. brass, copper, naval bronze, silicon bronze, Monel and stainless steel; third, large stocks of metals in bars, rods, wire, strip and other basic forms from which special fastenings can be quickly made according to specifications.

1945 CATALOG AVAILABLE. New in usefulness to the metal industries. 104 pages, 8½" x 11", 4 colors.

THE H. M. HARPER COMPANY
2611 Fletcher Street, Chicago 18, Illinois
BRANCH OFFICES: New York City • Philadelphia Los Angeles • Milwaukee • Cincinnati • Houston
Representatives in Principal Cities

HARPER
EVERLASTING FASTENINGS

BRASS • BRONZES • COPPER • MONEL • STAINLESS


American
REVOLVING AERIAL LADDER—
THE NEW design "American" Ladder, available the second half of this year, offers the utmost in safety, efficiency, ease of handling and low cost operation. It is unsurpassed for servicing street, highway and signal lights, trimming trees and maintenance and line construction work. • Among the important improvements are: — the Counter balancing has been eliminated and the springs relocated to a position on the ladder so that with a slight uniform force the ladder can be quickly and easily erected regardless of angle of ladder and adjusting frame: — and the number of lock pins on locking-pin assembly has been doubled. Write for details and specifications.
BUY MORE WAR BONDS
THE American COACH & BODY CO.
PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

employees do better work; however, a new lighting system is not necessarily the whole answer.

"There are four factors to be considered before right seeing conditions can be reached. This booklet presents in a brief manner information about each factor. Its purpose is to help office managers determine their needs before making any changes aimed at achieving better seeing conditions. The four factors are:

"1. The Task—or what we see.

"2. The Eyes—with which we see.

"3. The Light—which makes it possible for the eyes to function.

"4. The Surrounding—or the background against which the task or object is viewed."

The foregoing paragraphs are the text of the first page of an 8-page piece produced by the advertising staff of the Dallas (Texas) Power & Light Co. and entitled "Today's Office Lighting." It is used as a handout piece by lighting salesmen and also is included with individually typed presentations to customers. According to P. M. Rutherford, Jr., advertising manager, customer and other reaction to it has been even more favorable than was hoped.

The reason the piece has been so well received is that it is genuinely informative in an attractive, good-humored way. It tells, in text illustrated with amiable little cartoons, that:

The task determines the lighting level required.

The eyes should be corrected for visual defects.

The background or visual environment is important to eye comfort.

Ceilings should be white.

Walls should be colored.

Floors should be light.

Desk tops should have a dull finish.

Other sources of glare should be controlled.

The lighting system should be designed for its purpose.

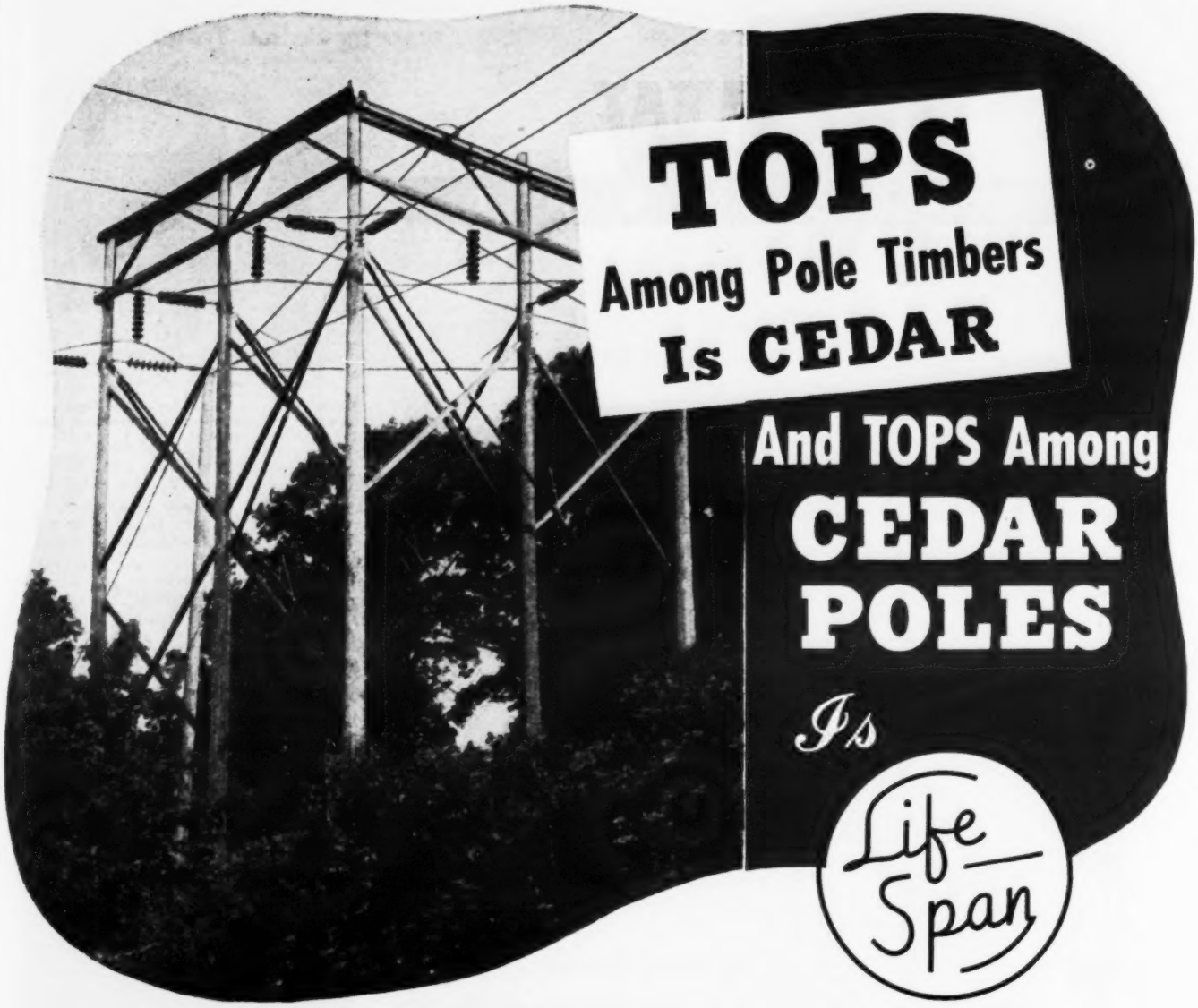
The proper amount of light should be provided.

The luminaire should shield the lamp bulb.

Natural lighting may be used effectively.

Adequate maintenance pays.

And, finally, the Dallas Power & Light Co. has a staff of competent illuminating engineers to consult with customers and suggest improvements of their lighting.



TOPS Among Pole Timbers Is CEDAR

And TOPS Among CEDAR POLES

Is Life Span

DECAY-RESISTANT FULL LENGTH

Sold only by the following:

NAUGLE POLE & TIE CORP.
Minneapolis, Minnesota

PAGE AND HILL CO.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane • Minneapolis

SCHAEFER-HITCHCOCK
Sandpoint, Idaho
Supplies for Joslyn

For the qualities that go to make good power poles, cedar is supreme. And outstanding among cedar poles—for high decay resistance and long life—are Life Span Cedar Poles. That's because Life-Span Cedar Poles have been treated full length with highly chlorinated phenol that renders them immune to termites, fungi and decay organisms of all kinds. This full-length treatment is in addition to the regular butt treatment. For full protection—full length—the pole to specify is Life-Span!

CONSOLIDATED TREATING CO.

MINNEAPOLIS ★ MINNESOTA

LIFE-SPAN CEDAR POLES

NEW EQUIPMENT

Transformer

Cold cathode transformer. **Sola Electric Co.**, 2525 Claybourn Ave., Chicago 14, Ill.

Transformer is 900-v. unit for use with two standard 8 ft., 20 or 25 mm. fluorescent lamps with gas pressures varying from 3 to 7 mm. It is reported to maintain constant light output with line voltage fluctuations of plus or minus 10 percent. Failure of one lamp is said to have no effect upon the other. Five knock-outs permit leads to be brought in from top, bottom or sides.

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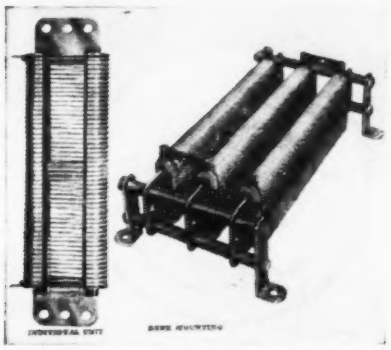
Resistor Units



Type EW resistor units: 500 volts a.c. or d.c. **Mullenbach Electrical Mfg. Co.**, 2300 E. 27th St., Los Angeles 11, Calif.

Resistor units for individual or bank mounting in capacities from 0.8 ohms and 25 amp. to 20 ohms and 5 amp. Units are said to comply with U.S.N. Spec. 17-P-4. All parts are reported as corrosion resistant.

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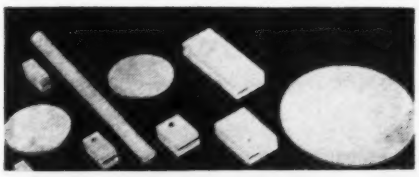
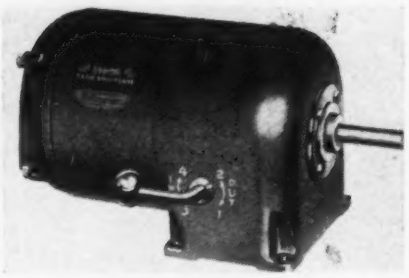
Insulation



"K" series ceramic capacitor dielectric: range of dielectric constants from 8 to 15 at one megacycle. **Myralex Corp. of America**, Clifton, N. J.

Insulation, which offers a selective range of dielectric constants, is available in sheets 14 by 18 in. in thicknesses of $\frac{1}{8}$ to 1 in.; thickness down to $\frac{3}{32}$ in. in smaller sheets, and 14 and 18-in. rods, $\frac{1}{4}$ to 1 in. in diameter. Material is said to be machinable and to be moldable incorporating metal electrodes or inserts.

Gearshift Drive

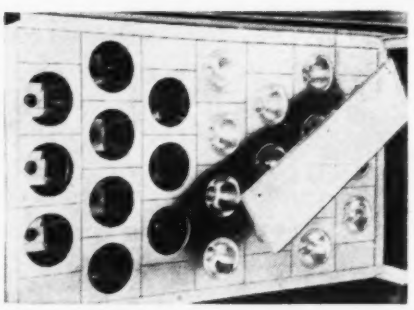


Type R selective speed gearshift drive: ½ and ¾ hp. at 1200 r.p.m. and 1 hp. at 1800 r.p.m.; ratios 1 to 1, 1.33 to 1, 2 to 1 and 4 to 1; 2 or 3 phase; 50 or 60 cy.; 220, 440 or 550 v.; reversible. **Lima Electric Motor Co.**, 2301 Findlay Rd., Lima, Ohio.

Unit is designed for power machine tools and other equipment requiring motor capacities of 1 hp. or less. Motor is of semi-enclosed, drip-proof, ball bearing type. Shift is performed by means of a small lever which can be extended to any convenient position. Single phase units in above size will be available when conditions permit.

•

Infra-red Ovens

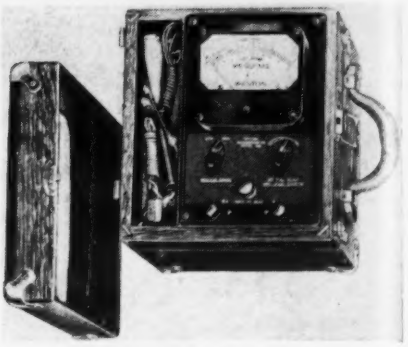


Infra-red ovens: staggered R-40 lamps. **Jensen Specialties, Inc.**, Detroit, Mich.

"Nest of heat" method of spacing R-40 reflector lamps in infra-red ovens is reported to result in even distribution of rays. "Nesting" is achieved by advancing lamps in each row a quarter step or a half step or more beyond lamps in preceding row, according to requirements of the job. Method is said to result in shorter baking time cycle.

BUYING ELECTRICAL EQUIPMENT? — McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Insulation Tester



Model 796 insulation tester: self-contained batteries. **Weston Electrical Instrument Corp.**, 617 Freylinghuysen Ave., Newark, 5, N. Y.

Direct reading insulation tester is said to provide complete insulation and resistance tests up to 200 megohms at a test potential of 350 to 500 volts d.c. Reported as usable for general resistance measurements from 10,000 ohms to 200 megohms. Unit operates from self-contained batteries and is said to have no vibrators nor tubes. Tests reported as readily made in cramped quarters or hard-to-get-at places

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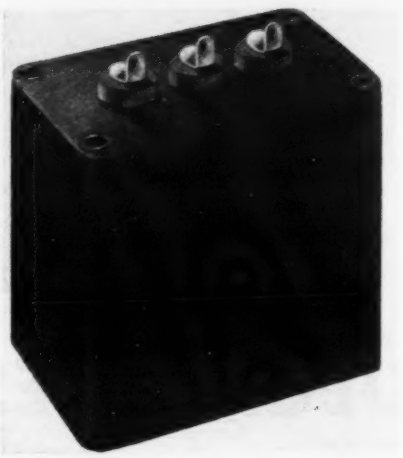
Filters



Type L.P.I. and H.P.I. low and high pass filters: size 1½ by 2½ by 2½ in. **United Transformer Co.**, 150 Varick St., New York 13, N. Y.

Hermetically sealed units employ a dual alloy magnetic shield which is said to reduce inductive pick up to 150 Mv per gauss. Filters are designed for either interstage or line impedances and are available for any cutoff frequency from 200 to 10,000 cycles.

•

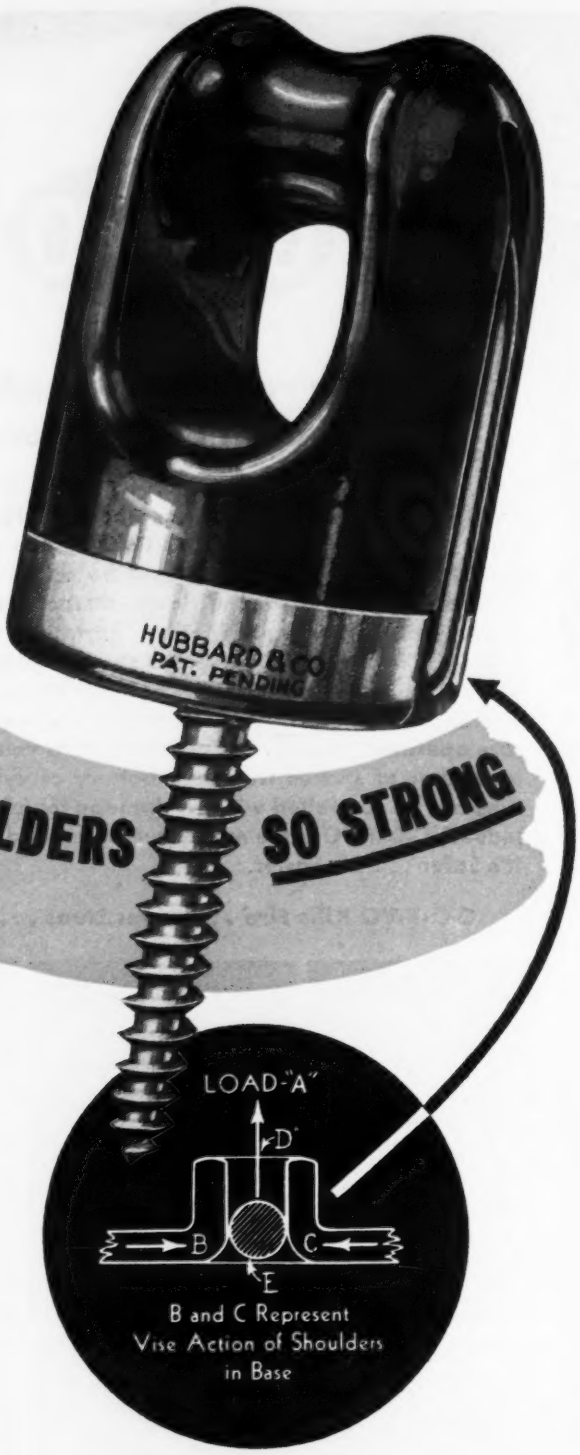
Boiler Control Panel

Prefabricated boiler control panel. **Bailey Meter Co.**, 1050 Ivanhoe Rd., Cleveland 10, Ohio.

Prefabricated boiler control panels which include necessary connecting piping and electrical wiring for the operation of metering equipment and boiler control systems are said to simplify the users problem of installation. All piping and wiring necessary for operation is installed as a unit according to a coordinated and prearranged plan. Small units such as valves, relays, switches, signal lights, and the more sturdy and light-weight instruments are mounted and

WHY?

ARE HUBBARD NO. 4-11-44 WIREHOLDERS SO STRONG



When a dead-end load is applied to a Hubbard 4-11-44 Wireholder, the first thing that happens is a close conformation to the porcelain of the Copperweld wire bail, which runs around the wire hole. This distributes a compression load over the largest possible area of the porcelain. *The metal bail carries the load,* the porcelain merely rides the bail like a saddle.

This is evident on observing the construction of the Hubbard 4-11-44. But not so well understood, is how the bail-fastening to the base stands up so well. At first glance it would seem that increased loading would simply straighten out the hooked ends of the bail and cause them to let go. By referring to the diagram it will be seen why this is not so.

As the load is increased at "A" beyond normal strain, the base starts to "bow" up slightly at "D". Immediately the shoulders at "B" and "C" are drawn in against the bail "E", gripping it over a fairly large area, like the jaws of a vise. The harder the pull, the tighter the grip until the ultimate of the bail wire is reached.

*Tests have shown that before the bail breaks the normal mounting would long since have pulled loose. Attached to a solid beam of hard wood one Hubbard 4-11-44 Wireholder will support the weight of a light automobile.

**The full strength of any wireholder will not be developed by a poor mounting. Thin siding, soft splintery wood or loose bricks will give way under a very low strain. Avoid weak mounting.*

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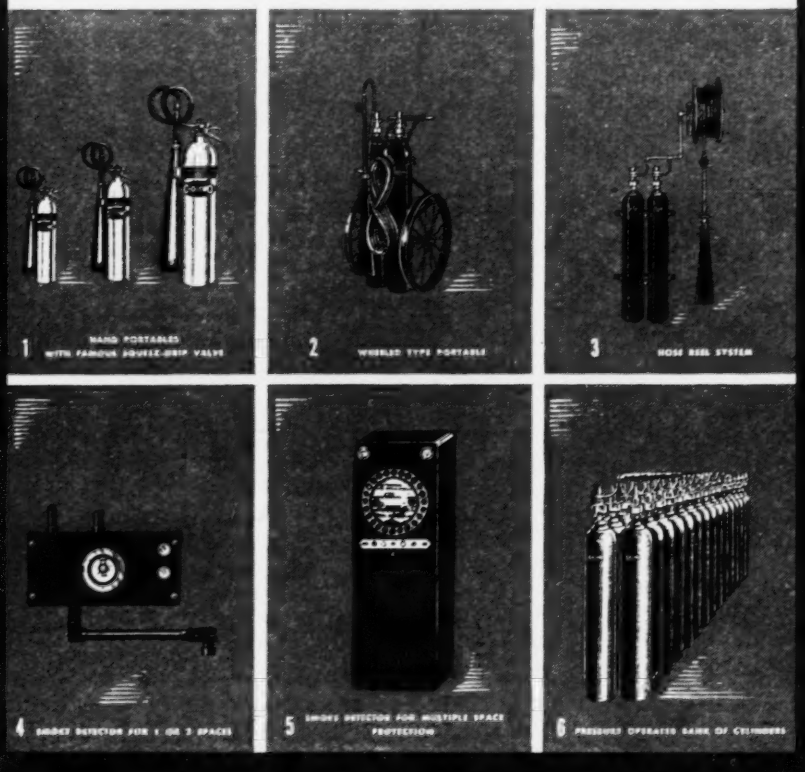
You learn some amazing things about modern fire protection when you see how quickly C-O-TWO detects and extinguishes fires. In the first place, there will be no clean-up or mop-up after a fire. Hence no shut down. Carbon dioxide gas is the fastest non-damaging fire killer. Portables with the famous C-O-TWO Squeez-Grip valve are so easy to operate that even a child can use them. C-O-TWO Smoke Detecting cabinets and Fire Extinguishing Systems, with the original C-O-TWO pressure operated release, can be installed in your plant to protect a number of spaces from one battery of cylinders. Electrical fires can be controlled without damage to valuable machinery. Indeed, C-O-TWO is the most modern method of fire protection. It's Safer . . . It's Faster.

C-O-TWO Kills Fire . . . Saves Lives . . . It's Modern



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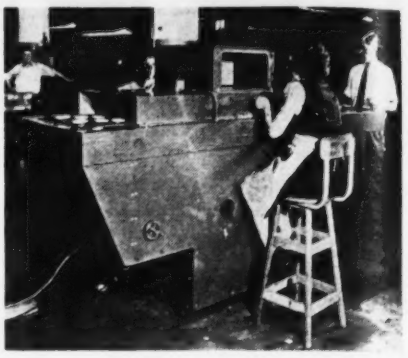
NEWARK 1 NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

connected ready for service. Heavy instruments or instruments having delicate mechanisms are shipped separately; but cutout spaces, drilling and all necessary connections are provided so that installation in the field is quickly and easily completed. Connecting piping and electrical wiring are brought to convenient terminals which are tagged so that no time or effort is lost in connecting panel to the various factors which it controls.

•

Conveyor-type X-ray



Model 150 CF conveyor-type X-ray; **North American Phillips Co., Inc.**, 100 East 42nd St., New York, N. Y.

Conveyor-type X-ray fluoroscope allows one or two operators to view moving objects through the indirect fluoroscopic head and mark defective pieces without stopping the conveyor. Unit requires 230 volts at 50-60 cycles.

•

Heating Element Flux

"Chanite Flux"; **Chanite Sales Co.**, 914 South Main St., Fort Worth, Tex.

An alloy used to repair the heating element in irons, coffee urns, waffle irons, etc., and in industrial electrical furnaces. Repair is made by joining both ends at the break by stretching or insertion of small piece of element, placing small amount of flux on ends to be welded and energizing circuit while holding ends together with match or small stick. Heat from element is utilized in making the weld.

•

Toaster-Cooker

"Breakfaster"; 110 v.a.c. or d.c.; **Calkins Appliance Corp.**, South Bend, Ind.

Unit is designed to prepare toast and coffee or similar foods simultaneously on one appliance. Single heating element is utilized for both the cooking and toasting functions. Upper surface forms a hot plate; compartment below serves as a grill. The 2½ lb. unit is chromium plated and has plastic handles which form the base.

From Maine to California, from small villages to great cities, plans are being formulated for improved Street Lighting . . . Some day, perhaps soon, these blue-print projects will have to be put into operation . . . Here in one comprehensive authoritative book are all the answers as to *how* to obtain the efficient, economical illumination which you have planned for your particular locality. It has been acclaimed as the "Code" for postwar Street Lighting. It is splendidly illustrated and includes a series of actual layouts for traffic arteries, business and residential streets. Send for your copy.

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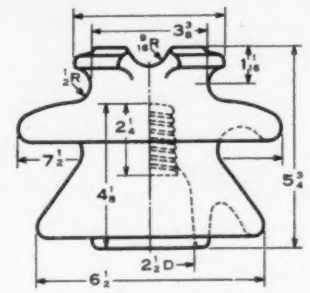
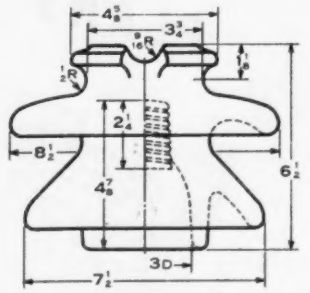
TYPICAL DESIGNS



NO. 1917-M
27 Kv. Rating

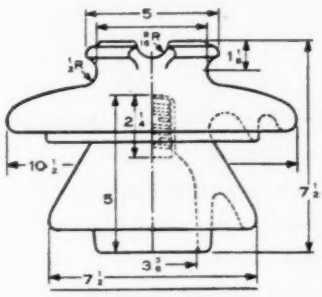
Dry Flashover	95 Kv.
Wet Flashover	65 Kv.
Rec. Pin Height	7 In.
Std. Pkg. Bbl.	25



NO. 1925-M
35 Kv. Rating

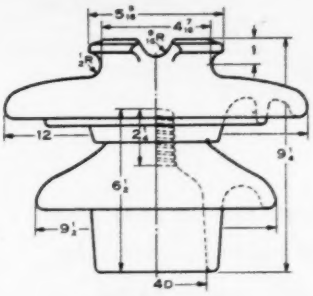
Dry Flashover	110 Kv.
Wet Flashover	75 Kv.
Rec. Pin Height	8 In.
Std. Pkg. Crate	8

All Thomas Pin Type Insulators can be furnished in "Quiet-Type" insulators for the positive elimination of insulator radio interference. To order "Quiet-Types" simply specify "Q-T" after catalog number.



NO. 1924-M
45 Kv. Rating

Dry Flashover	125 Kv.
Wet Flashover	85 Kv.
Rec. Pin Height	9 In.
Std. Pkg. Crate	6



NO. 2126-M
55 Kv. Rating

Dry Flashover	145 Kv.
Wet Flashover	100 Kv.
Rec. Pin Height	10 In.
Std. Pkg. Crate	3

The above one-piece designs can also be furnished in two-part designs when preferred. Both designs are very rugged, well balanced, and proved by years of continuous line service.

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Lisbon, Ohio

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TECHNICAL LITERATURE

Safety Report—Publication No. L4-1945 compiled by and obtainable from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y., at price of 10 cents per copy. Safety engineers in utilities in United States and Canada assisted in the "linemen cutout" study. "Cutout" is defined as when a gaff either fails to enter or fails to stay in a pole while a lineman is climbing or working on the pole and depending on the gaff for support at the time. Contains information on causes of cutouts and their prevention. It also contains illustrations of safe and unsafe gaffs and types of gauges used for measuring gaffs.

Magnesium Castings—Four page brochure containing "Facts for the Designer" on the subject of magnesium castings may be procured from Superior Bearing Bronze Co., Inc., 140 Banker St., Brooklyn 22, N. Y. Contains technical data on the following—property considerations in design, finish metal allowances, threads, stress concentration, section junctions and fillets and lists comparative properties of magnesium and other structural metals.

Color Selection—Two booklets on color selection may be obtained from the Arco Co., Cleveland, Ohio. One is a selection guide which permits persons without detailed technical understanding to specify correct shades that minimize fatigue and promote safety by the use of 18 rules. The second, Color Power for Industry, by illustrations and text, describes the how of reducing eye fatigue in plants.

Testing—Bulletin "Electrical Test Instruments" reduces laboratory circuits and techniques to simple terms for lay usage in industry. Instruments featured are direct-reading comparison bridge, capacity and resistance limit bridges, resistance and capacitance decades, Wheatstone bridge, voltage breakdown testers, Kelvin bridge, megohm bridge, and conductivity apparatus. Copies may be had upon request from Industrial Instruments, Inc., 17 Pollock Ave., Jersey City, N. J.

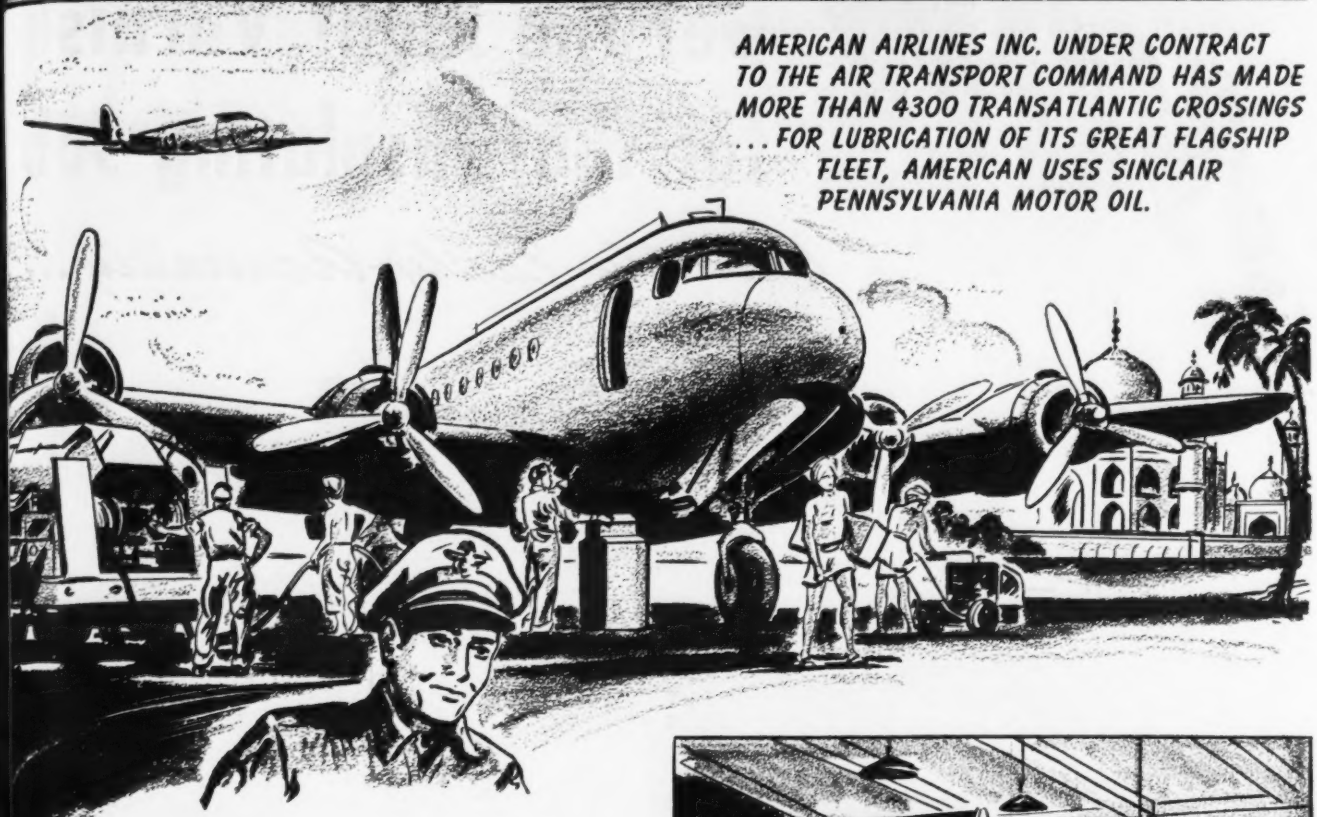
A.S.A. Standard—New American Standard for Sound Level Meters, Z24.3-1944, used for measuring the intensities of noise and other sounds in order to evaluate their relative effect on the ear, has been approved by and may be obtained from the American Standards Association, 70 East 45th St., New York 17, N. Y. at 25 cents per copy. New standard supersedes that of 1936 and has been brought up to date in accordance with developments in acoustical practice in the sound measurement field.

Metal—A 16-page bulletin on Rigid zed Metals which illustrates and describes war and post-war applications due to the materials properties. Also described are design and fabrication simplification of special applications of interest to electrical equipment and appliance designers. Copies are available from Rigid-Tex Corp., Buffalo 3, N. Y.

Castings—A booklet issued by the Beryllium Corp. of Pennsylvania, Reading, Pa. which is devoted mainly to beryllium-copper as a casting alloy. It is freely illustrated, lists physical properties of the alloys, states some of the recommendations on heat treatment and machining practice.

Welders' Clothing—Pocket size booklet describing and listing specification of welders' safety clothing obtainable from American Optical Co., Southbridge, Mass. Booklet is well illustrated with various items of clothing which give workmen protection against sparks.

Do you know that . . .



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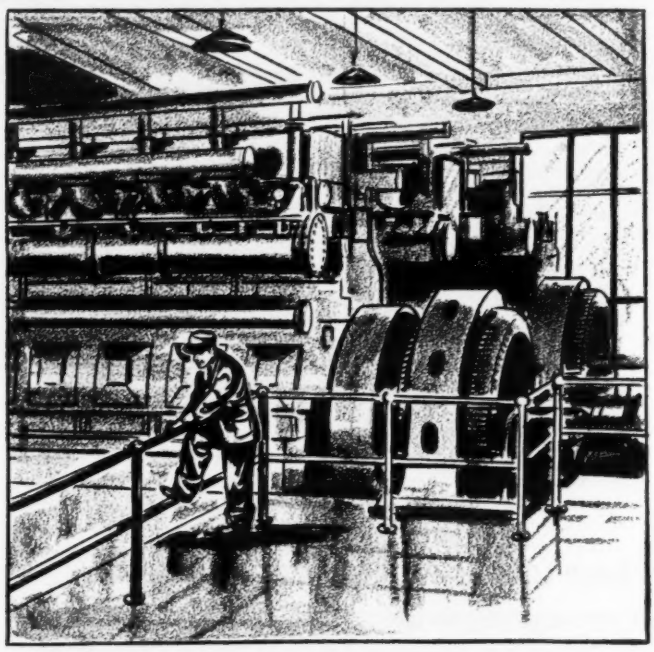

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Heat Endurance
Resistance to: Mineral Oil, Acid, Alkali, Moisture
Baking Time in Hours: 110°C, 125°C, 135°C, 150°C
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RECOMMENDED APPLICATIONS
1 TREATING COILS AND WINDINGS
- Random-Wound Stators and Low-Speed Rotors
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- Form-Wound, High-Voltage Stators and Rotors
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- Transformer Windings, Control Coils, Magnet Coils
- Large Field Coils, Brake Coils
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- Quick Dry, Oil-Proof, Formex Windings
- Resistance to Oil, Weather, Moisture
- For Finishing Coils, Motors, and Compensators where baking is not practical
3 GENERAL REPAIR WORK
- Air Dry: Resistance to Acid, Moisture and Weather
- Air Dry and Quick Baking: Resistance to Acid, Moisture, Oil and Weather
Excellent
Good
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A quick glance at this handy, easy-to-use Varnish Selector gives you all the facts on 7 outstanding insulating varnishes — characteristics, applications, baking and drying time, base, thinner, viscosity — everything you want to know. Ask your local G-E Merchandise Distributor for one and you'll always have this essential information at your finger tips, ready to use. A list of G-E Distributors is available on request from Section RIM352-15, Resin and Insulation Materials Division, General Electric Company, Schenectady 5, New York.

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GENERAL ELECTRIC

EVERY FRACTIONAL HORSEPOWER MOTOR HAS A BRUSH PROBLEM

. . . and here's why

A fractional horsepower motor brush for use on 110 V. requires an entirely different composition of ingredients than one to be used on a similar motor but, say, for 6 V. operation. Again, a brush that may do very well on one make or type of vacuum cleaner will be regarded as only mediocre on another—even though the points of electrical or mechanical difference are so small as to seem unimportant.

Almost without exception, small motors differ in their brush requirements. Even a slight difference in the "mix" of a brush may—and often does—make a whale of a difference in its life or performance. Emphasis on long life, or quiet operation, or minimum commutator wear, or various other factors should all be considered—*and in the light of the specific application!*

Backed with unparalleled experience in the production of more small motor brushes for more applications than any other manufacturer, Stackpole engineers are in an enviable position to help you in this all-important respect. Moreover, for 25 years, it has been their practice to have customers send their equipment to our laboratories. Thus, Stackpole brush recommendations are made NOT by guesswork, but on the sound basis of exhaustive tests on the actual equipment.

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Brushes and Contacts (All carbon, graphite, metal, and composition types)

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STACKPOLE

THE NATION'S LARGEST PRODUCER OF SMALL MOTOR BRUSHES

NEWS ABOUT PEOPLE

Two Nela Park Officials Promoted by G. E. Co.

E. E. Potter, who for the past 14 years has been eastern general sales manager of General Electric Lamp Department at Nela Park headquarters, has been elected a G-E commercial vice-president. P. D. Parker, who served over the same period as assistant general sales manager of the lamp department's eastern sales division, has become general sales manager of that division.

E. E. Potter

As commercial vice president, Mr. Potter becomes a member of President Charles E. Wilson's staff. In his new capacity, he will become responsible for coordinating the diversified interests of the company in all its customer relations in the District of Columbia. His headquarters will be in Washington, D. C., where he will be further responsible for providing assistance to the several G-E departments and to affiliated concerns in all company customer relations in the District of Columbia. This will involve principally General Electric's relations with the Government and its agencies.

Mr. Parker, as chairman of the National Emergency Committee of the G. E. Lamp Department, has shouldered a large share of the responsibility of handling the department's product distribution problems brought on by the war. He has worked closely with the War Production Board with respect to all G. E. Lamp Department wartime production.

Mr. Parker joined General Electric's Edison Lamp Works at Harrison, N. J., as a miniature lamp salesman in 1916. He had previously served five years as a salesman for New York Edison Co. In 1925, he was made sales manager of the Edison Lamp Work's miniature lamp division. He took his post as assistant general sales manager of the Lamp Department's eastern sales division, Nela Park, in 1930.

Mr. Potter started his career with the Edison Lamp Works at Harrison, N. J., in 1910. He was soon advanced to lamp manager of the Syracuse (N. Y.) office and to lamp specialist for the New York district. By 1919, Mr. Potter was appointed manager of the N. Y. district, which position he held until 1924 when he became assistant general sales manager of Edison Lamp Works. He was appointed general sales manager of the Lamp Department's eastern sales division at Nela Park in 1930.

P. D. Parker

•

► D. THEODORE SCHWAB, load dispatcher for the Indiana Service Corp., Fort Wayne, Ind., has resigned to become a rate engineer with the R.E.A. in St. Louis, Mo.

N. J. Power & Light Elects Moses Vice-President

William F. Moses, who has been domestic sales manager for New Jersey Power & Light Co., Dover, N. J., has been elected a vice-president in charge of customer and employee relations.

Mr. Moses was district manager in Cortland for New York State Electric & Gas Corp., an affiliated company, before joining the New Jersey utility. Previous to 1944 he was employed in sales work for the New York utility in Auburn, Geneva and Binghamton, his service with the organization beginning in 1915.

W. F. Moses

Donald M. Moroughan has been appointed domestic sales manager to succeed Mr. Moses. Mr. Moroughan has had 20 years experience in the utility business, having started in Messina, N. Y., in 1925. From 1929 to 1934 he was in the sales department of the New York State Electric & Gas Corp., at Ithaca and Walton, N. Y. From 1934 to 1945, he was sales supervisor for Metropolitan Edison Co. at Easton, Pa., and has also been associated with New Jersey Power & Light Co. at Phillipsburg, N. J.

Ralph N. Malehorn has been named comptroller, Paul M. Lenhart secretary and assistant treasurer and Mrs. Eunice G. Ackerman assistant secretary.

•

► RUSSELL W. SYMES, vice-president and secretary of the Detroit Edison Co., has been elected a member of the board of directors.

► NEWTON JACKSON, formerly electrical engineer at Charlottesville, Va., for the Virginia Electric & Power Co., has been appointed substation design engineer in the system engineering department of the company at Richmond, Va. R. COOPER BAILEY, who has been serving as Lieutenant Commander in

Steel in Stock!

No!—buyers don't run to the 11 Ryerson Steel-Service Plants to buy steel, as they do to a cigarette counter when the "in stock" sign is out . . . but we sometimes have almost as much difficulty keeping up with demand. Every week thousands of orders speed steel from Ryerson stocks to war plants and essential industries throughout the country.

Why? . . . The reasons are simple and basic. Ryerson plants stock more than 10,000 kinds, shapes and sizes of steel . . . Service is personal, intelligent and helpful . . . Equipment and "know-how" are at hand to cut and otherwise prepare steel the way you want it . . . Deliveries are quick. But most important is Ryerson dependability, demonstrated by 102 years of steel service, and the determination to deliver to you, if humanly possible, the steel you want when you want it.

Ask your Purchasing Executive to let you see the Ryerson Stock List. You'll realize what we mean by 10,000 kinds, shapes and sizes of steel. If your Purchasing Executive is without the Ryerson Book be sure he gets one from our nearest plant.

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INFRA-RED BAKES FINISH ON HUGE GUN . . . in 22 MINUTES!

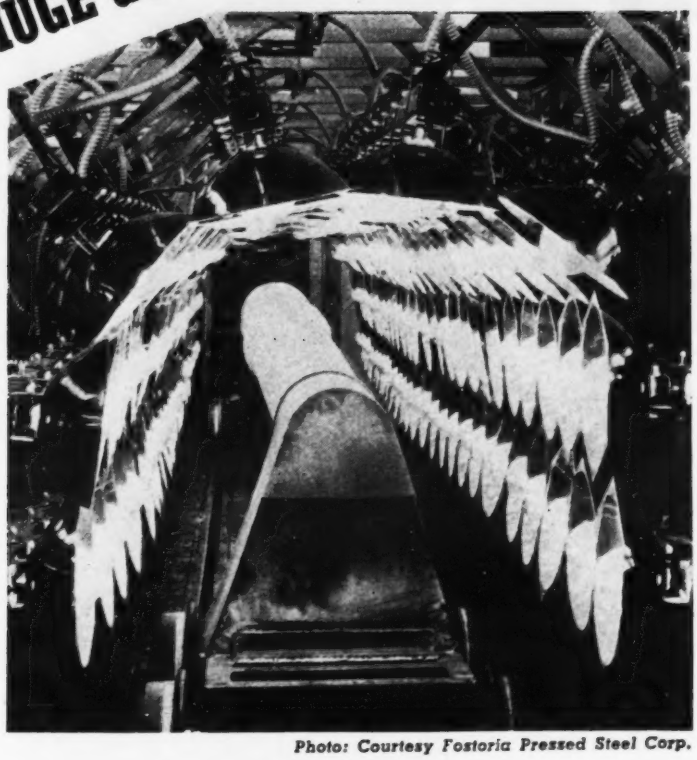

Photo: Courtesy Fostoria Pressed Steel Corp.

THIS IS A BIG TEN INCH GUN

24 feet long, weighing 3½ tons. It's just had the finish sprayed on, and now it's traveling through the INFRA-RED Tunnel, turning on its axis, to expose every part of its surface evenly. Infra-Red takes only 22 minutes to bake that wet spray to a solid, uniform, resistant finish!

BIRDSEYE INFRA-RED HEAT LAMPS

are standard for most infra-red tunnels, ovens, and other production line installations. There is no mystery or hocus-pocus about the really dramatic results possible with Infra-Red. However, Infra-Red Heating is a science, and, for maximum efficiency, *Birdseye Lamps should be used with scientifically engineered equipment.* We will gladly furnish names of manufacturers of such equipment.

WABASH APPLIANCE CORPORATION

345 Carroll Street — Brooklyn 31, N. Y.

the U. S. Naval Reserve, has been appointed electrical engineer in the system engineering department at Richmond, Va. Prior to entering military service, Mr. Bailey was relay engineer in the company's operating department at Richmond.

•

Lindseth Assumes Broader Duties in Cleveland

Elmer L. Lindseth was elected executive vice-president of the Cleveland Electric Illuminating Co. at a recent meeting of the board of directors. In this newly created position, Mr. Lindseth will assist Eben G. Crawford, president, in the general direction of the company's business.

He began with the Cleveland utility in 1924 as a junior test engineer. Subsequently he became production engineer, assistant to the executive engineer, assistant to the president and in 1942 vice-president in charge of sales and related matters.

A graduate of Miami University, Case School of Applied Science and Yale University, Mr. Lindseth has been active in post-war planning for the past two years and is Cleveland chairman of the Committee for Economic Development. He was formerly vice-chairman of the Greater Cleveland Post-war Planning Council.

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► C. H. Moses, president of Arkansas Power & Light Co., has been elected president of the recently merged Arkansas Economic Council and Arkansas State Chamber of Commerce. Mr. Moses participated in the organization of the Economic Council, which was formed to develop post-war industries in the state.

► George G. Kuhn, purchasing agent, United Light & Power Service Co., Davenport, Iowa, has retired. Until a permanent appointment is made, Waldo

CRESCENT GRIPS
— A TYPE FOR EVERY LINE WORK REQUIREMENT

No. 383 Opening: 5/32 to 3/8" Tested to 5000 lbs.
No. 385 Opening: 3/8 to 1-3/16" Tested to 10,000 lbs.

● **Proven to be one of the most popular and dependable tools of this type yet developed, Crescent Grips Nos. 383 and 385 combine many exclusive advantages with the best features of Crescent's famous Buffalo Grips and Haven's Clamps. Considering their capacity, they are extremely light in weight, absolutely jam-proof and quickly released by a flip of the rope. A simple hook lock prevents them dropping from the wire and injuring workmen below.**

Nos. 383 and 385 are supplied regularly with corrugated jaws, but can be furnished with smooth jaws for gripping aluminum wire without slippage or injury. These Grips are drop-forged from alloy steel, heat-treated, cadmium-plated, and individually tested to their full "safe load" capacity. Their large eye easily accommodates heavy tackle block hooks. Two other types of Crescent Grips are shown in right-hand panel, still others are illustrated in the Crescent catalog. Write for your copy today.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT HAVEN'S GRIP

A recently redesigned tool of great strength. Note the solid loop which cannot pull out. Made of forged alloy steel and carefully heat treated. Unusually large eye will accommodate heavy duty hooks.

FINISH: *Cadmium plate.*

NO.	MAX. OPENING	MIN. OPENING	SAFE LOAD	WEIGHT
368	¼ inch	.050 inch	2500 lbs.	1 lb. 2 oz.
369	½ inch	⅛ inch	5000 lbs.	2 lbs. 7 oz.

S & H AMERICAN COME ALONG

For handling bare and barbed wires. Made of malleable iron, reinforced at all points bearing strain. Jaws slotted to prevent wire from working out. Gripping jaws are of hardened steel.

FINISH: *Cadmium plate.*

NUMBER	SIZE	WEIGHT, DOZ.
266	for No. 0 and smaller wire	17 lbs.

If you're the production champion of your industry, or aspire to be, you know what good lighting, and good lamps, mean to quality, quantity, safety and true economy of production.

CHAMPION *Fluorescent* and **Incandescent** Lamps are designed, manufactured and tested to be worthy of the responsibility for dependable, low cost industrial lighting.

CHAMPION lighting engineers are at your service, without charge, to provide competent and unbiased assistance on your industrial lighting problems.

CHAMPION industrial distributors combine with Champion's specialized industrial production set-up to supply your lamp needs with the utmost efficiency at lowest cost lighting effectiveness and lamp performance taken into account.

Look for the Diamond mark on *Fluorescent* and **Incandescent** lamps. It's the mark of an industrial production CHAMPION.

CHAMPION ◇ W 40 DAYLIGHT

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

Fahrner will serve as acting purchasing agent. Mr. Kuhn's retirement marks the end of a 45-year period of service in the public utility field, 37 years of which have been spent in the purchasing end of the business.

•

New Sales Manager Named By Metropolitan Device

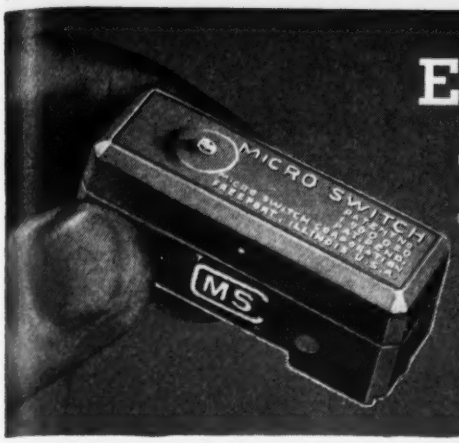
Announcement has been made by the Metropolitan Device Corp., Brooklyn, N. Y., of the appointment of Edward J. Martin to the position of sales manager.

Prior to joining the Metropolitan Device staff, Mr. Martin spent nine years

with the O. Z. Electrical Manufacturing Co., Brooklyn, in the capacity of sales manager. From 1919 to 1936 he was in the contracting and engineering field, most of the time with J. Livingston & Co. and Fishbach and Moore, Inc.

•

▶ CLYDE J. HOLMES, vice-president, director and general counsel of the Consumers Power Co., Jackson, Mich., resigned recently because of ill health, after an association of 38 years with Consumers and predecessor companies. He will be succeeded as general counsel and director by WALTER D. KLINE, who has been with the company's legal department since 1916. As a young lawyer in Grand Rapids, Mich., early in the century, Mr. Holmes became interested in Michigan's waterpower possibilities. With three other men he acquired lands along the Manistee River which were purchased in 1907 by W. A. Foote, founder of several electric power enterprises which were later merged in the Consumers Power Co. Mr. Foote retained Mr. Holmes as his personal attorney and in 1914 Mr. Holmes moved to Jackson to become general counsel for the predecessors of Consumers Power Co. He assisted in the handling of legal work in connection with the organization of the



Engineers Have Tested these MICRO SWITCH Characteristics by Years of Successful Use! . . .

MICRO SWITCH precision snap-action switches have been found invaluable by utility engineers because, more than any other switch, they have the capacity to control substantial amounts of power and yet operate in a small space.

Almost every branch of industry which uses precise electrical controls has turned to Micro Switch because this company not only supplies the tiny plastic enclosed switch but makes it fit the job with a complete line of accessories, actuators and housings.

MICRO SWITCH products meet these requirements

√ SMALL SIZE:
No larger than your thumb, the basic plastic enclosed switch measures 11/16″ x 27/32″ x 1-15/16″.

√ LIGHT WEIGHT:
With pin type plunger, the plastic enclosed switch weighs less than one ounce.

√ LONG LIFE:
Patented three-bladed beryllium copper spring gives millions of accurate repeat operations.

√ SMALL OPERATING FORCE:
Force required to operate the switch may be as little as one ounce . . . or as much as 60 ounces.

√ SMALL OPERATING MOVEMENT:
Movement of the operating plunger may be as little as .0004″ . . . or as much as ¼″.

√ GOOD ELECTRICAL CAPACITY:
Switch is Underwriters' listed and rated at 1200 VA-a.c. at 125 to 460 volts a.c.

Dependable, reliable operation of Micro Switch snap-action switches for millions of operations, under wide ranges of temperature and atmospheric conditions, recommend them for your switching requirements. Send for Micro Switch Handbook-Catalog No. 60 for complete details as to electrical characteristics, construction features, housings and actuators.

"Uses Unlimited"—a dramatic talking motion picture of Micro Switches, in color, is available to industrial groups, training classes, schools and colleges, through Y.M.C.A. Motion Picture Bureau, New York, Chicago, San Francisco. Sizes: 16 mm. Length: 40 minutes. Write us for details.

Two stars have been added to our "E" flag as further recognition to the men and women of Micro Switch for maintaining our war production standards.

Let's All Back the Attack

Buy Extra War Bonds

© 1945—First Industrial Corporation

MICRO MS SWITCH
TRADE MARK

A DIVISION OF FIRST INDUSTRIAL CORPORATION

Freeport, Illinois, U.S.A., Sales Offices in Principal Cities

IT'S THE RIGHT KIND OF RADIANT HEAT!

INFRA-RED EQUIPMENT MANUFACTURERS and PAINT MAKERS CAN AGREE ON PENETRAY

No longer is "passing-the-buck" a game to be played by paint men versus equipment men. No longer is the "buyer" in the middle as to whether paint or equipment is responsible for unsatisfactory results.

Penetray's exclusive ceramic coating improves wavelength, producing more intensive color, thorough curing and superior polymerization on metals. In addition, insect attraction is minimum because glare is reduced and improved uniformity of energy distribution results. Prove these points. Make your own tests for color and gloss; for corrosion and abrasives.

SALES ENGINEERS WILL CALL or DETAILS on REQUEST

LEARN TO SAY »PENETRAY«

VERD-A-RAY CORPORATION ▪ TOLEDO 5, OHIO

present company in 1915. In 1929 he was elected a vice-president of Consumers and held this position until the present time. Mr. Kline, who succeeds Mr. Holmes, has for the last several years held the title of general attorney for Consumers.

•

Edison Industries Names Larchar Vice-President

Sumner F. Larchar has been elected to the office of vice-president in charge of industrial relations for Thomas A. Edison, Inc., West Orange, N. J. Mr. Larchar has been with the Edison in-

dustries since 1920 and was made personnel manager in 1927.

He is a past-chairman of the Northern New Jersey chapter of the American Society of Safety Engineers, the industrial safety committee of the Newark Safety Council and the Northern New Jersey Personnel Group. Mr. Larchar is an Edison Pioneer.

•

▶ L. W. FOLEY has been appointed acting superintendent of transmission and generation; J. G. DOWER, acting superintendent of distribution; W. B. ROGERS acting superintendent and O. J. SABIN chief operator of the Falls Village hydroelectric plant of the Connecticut Power Co., all in the Housatonic division. B. H. MENKE, superintendent of transmission and distribution, has been given a leave of absence for several months on account of poor health.

▶ EDGAR C. ALGER has been appointed electrical engineer on the staff of the superintendent of drafting at the Quincy, Mass., yard of the Bethlehem Shipbuilding Corp., following about 40 years of service with the Bethlehem company at Quincy and elsewhere. His previous position as chief electrical draftsman has been filled by EUGENE FAVART. In his new position, Mr. Alger

★★★★4 OF THE 1008 METROPOLITAN ELECTRICAL UNITS *in* RADIO CITY

COMPLETE ELECTRICAL CONTROL by

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

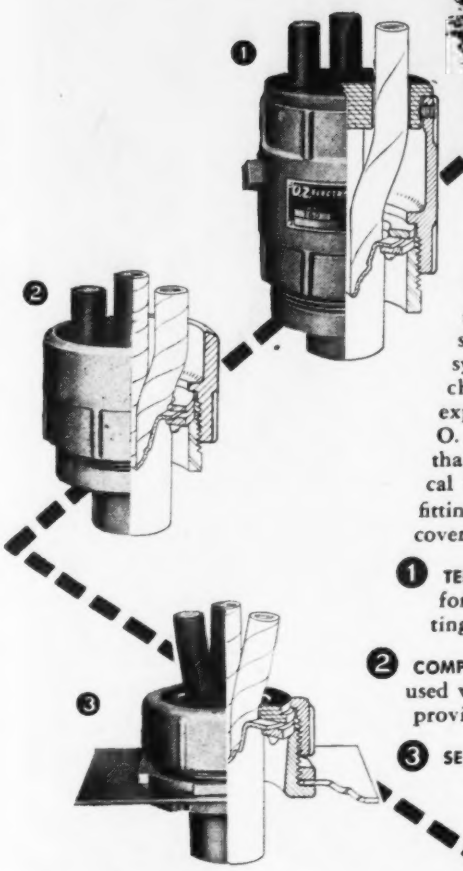
- Knife Switchboards
- Circuit Breaker Switchboards
- Dead Front Switchboards
- Battery Charging Switchboards
- Motor Control Switchboards
- Explosion-proof Switchboards
- Laboratory and Test Switchboards
- Control Switchboards
- Generator and Distribution Switchboards

METROPOLITAN ELECTRIC MANUFACTURING CO.

ESTABLISHED 1892
METROPOLITAN
TRADE MARK
ELECTRIC LIGHTING AND POWER DISTRIBUTION EQUIPMENT

GENERAL OFFICES: LONG ISLAND CITY, N. Y. FACTORIES: LONG ISLAND CITY, N. Y., & WEST WARREN, MASS.

NOW THERE'S AN O.Z. INDOOR CABLE TERMINATOR FOR EVERY JOB



O. Z. has added many new fittings to their line of Cable Terminators to meet the increased demand for their use in sewerage disposal plants, oil refineries, steel mills, office buildings, power stations, synthetic rubber plants, pumping stations, chemical and industrial plants, etc. In expanding their line of Cable Terminators, O. Z. engineers have drawn upon their more than 25 years close association with electrical industries to produce a complete line of fittings for use with lead covered and rubber covered cables in the following classifications:

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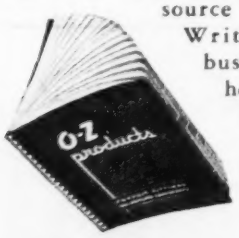
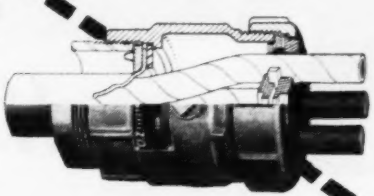
Designers and engineers who are planning post war building or reconversion can enjoy the purchasing advantage of using O. Z. as a single high-quality source of supply. Write on your business letterhead for your free copy.





HORIZONTAL TERMINATORS have an added sealing device at the top, permitting their use in any position.

"J" TERMINATORS incorporate the general principles of O. Z. Terminators, with the addition of a collapsible feature making an easily installed device for terminating and sealing or as a pulling and splicing chamber.

5672

O.Z. ELECTRICAL MFG. CO.
262 BOND STREET · BROOKLYN, 2 N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

will relinquish certain supervisory work in relation to production detail, and will concentrate upon broader aspects of electrical engineering at this yard in connection with naval and merchant marine shipbuilding.

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Utility Names Ackerman Farm Service Director

Walter T. Ackerman, formerly head of the department of agricultural engineering and research at the University of New Hampshire, has been appointed farm service director of the Connecticut Light & Power Co., with headquarters at Waterbury. Mr. Ackerman was connected in his earlier career with the University of Connecticut's mechanical and agricultural engineering depart-

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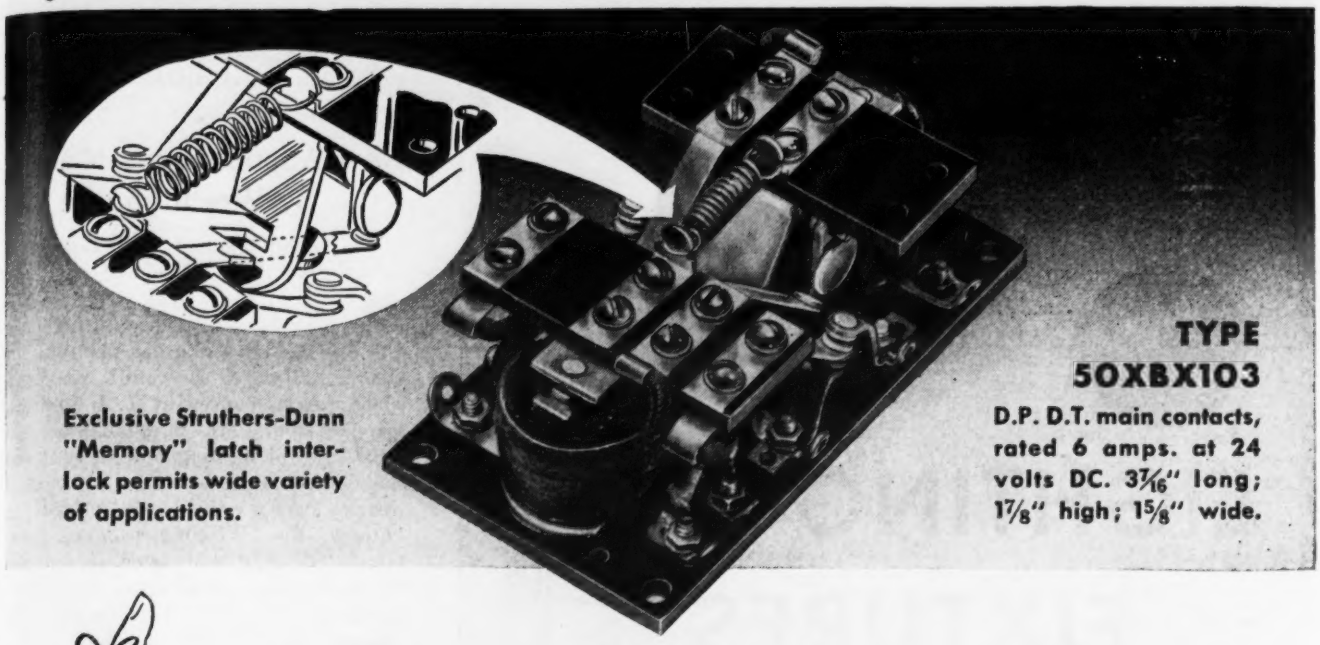

Exclusive Struthers-Dunn "Memory" latch interlock permits wide variety of applications.

TYPE 50XBX103

D.P. D.T. main contacts, rated 6 amps. at 24 volts DC. 3 7/16" long; 1 7/8" high; 1 5/8" wide.

A New Struthers-Dunn

"MEMORY" RELAY SERIES

Simplified Interlock—Symmetrical Design

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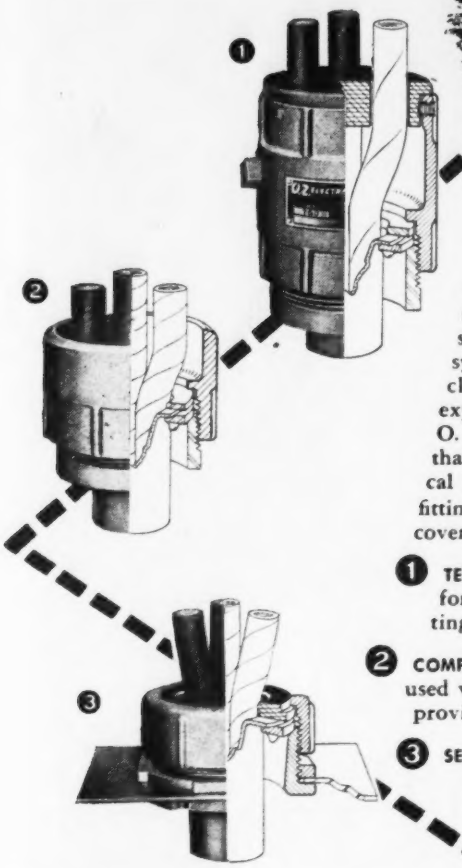
STRUTHERS-DUNN, INC., 1321 Arch Street, Philadelphia 7, Pa.

STRUTHERS-DUNN

5,288 RELAY TYPES

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HARTFORD INDIANAPOLIS • LOS ANGELES • MINNEAPOLIS • MONTREAL • NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

NOW THERE'S AN O.Z. INDOOR CABLE TERMINATOR FOR EVERY JOB



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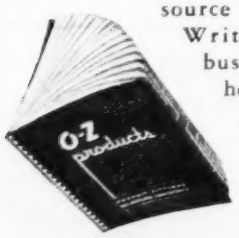

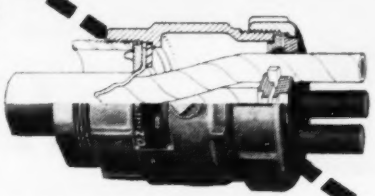

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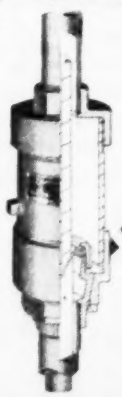

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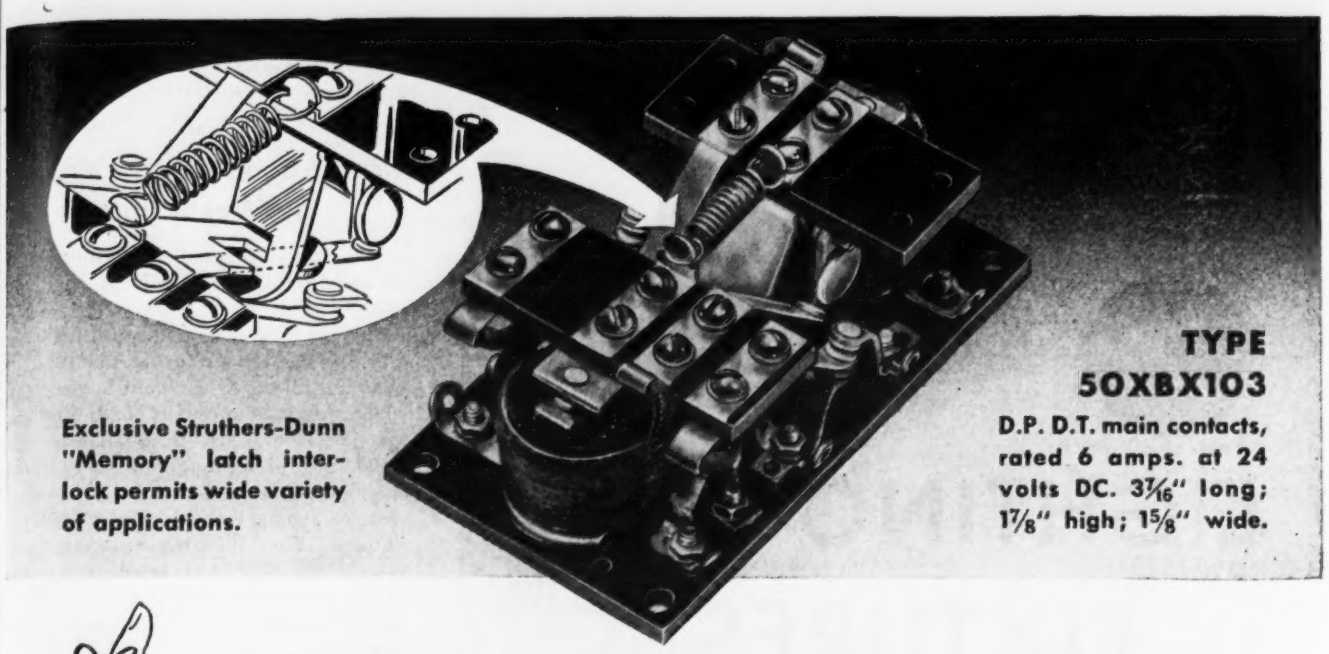

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40 Years' experience plus modern design is built into every R&S product.

R&S reflector contours are scientifically designed with high reflection factor providing a maximum of safe controlled light at minimum cost.

Thorough inspection and rigid factory controls insure longer life and low maintenance.

R&S explosion-proof lighting fixtures are supplied with a standardized base common to all sizes. Reflector globe assemblies of various capacities are interchangeable to suit conditions. No need to disturb mounting or electrical connections. Modern design simplifies mounting and affords a variety of conduit arrangements in one standard base. Installation costs are lower, parts fewer and ordering easier.

In hazardous areas, you can't afford to experiment. R&S explosion-proof and vaportight lighting fixtures are precision built and pass the rigid tests of Underwriters' Laboratories.

Specify R&S and be sure. Write for our 300-page catalog. You will find it valuable in planning new work and bettering existing installations to meet tomorrow's standards.

Since 1902

Please address Dept. No. B

RUSSELL & STOLL COMPANY

EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES AND EQUIPMENT. AUTOMATIC LOCKING "EVER-LOK" CONNECTORS

125 BARCLAY STREET · NEW YORK 7, N. Y.

tion to his duties as assistant secretary, Mr. Kealey has been associated with the Elliott organization for 23 years.

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New Appointments Made by Westinghouse Co.

The appointment of L. G. Burwinkel as assistant to vice-president has been announced by R. A. Neal, vice-president and sales manager of the Westinghouse Electric & Manufacturing and that of George S. Ryan as assistant to vice-president was announced by T. I. Phillips, vice-president. Mr. Burwinkel entered the employ of Westinghouse in 1924 and has served as assistant to the central district manager since 1940. Mr. Ryan entered the Westinghouse students' course in 1922 and later joined the Works Managers staff at the East Pittsburgh division. Since 1938 he has been manager of the feeder division.

Ernest P. Schroeder has been named manager of the foreign engineering department of the company and John T. Mathews has been made assistant manager. Mr. Schroeder, who will retain his duties as resident representative of the Westinghouse Electric International Co., succeeds D. I. Vinogradoff, who was transferred to the International company on special assignment. Mr. Mathews, formerly engineering representative of the International company in Argentina, will report to Mr. Schroeder.

Robert P. Smith has been appointed general farm sales manager of the Westinghouse Electric Supply Co., with offices in New York. Mr. Smith has returned to Westinghouse after being on leave of absence with the War Production Board in Washington. As head of this new department, Mr. Smith's duties will include analysis of farm market possibilities for appliances, radio, and electrical apparatus.

J. Howard Wenner, formerly lighting specialist for the Westinghouse Electric & Manufacturing Co. of Allentown, has been promoted to the position of street lighting specialist for the company's entire Middle Atlantic District.

Election of Walter E. Benoit as vice-president of Westinghouse Radio Stations, Inc., has been announced. Mr. Benoit will take over substantial executive duties for all Westinghouse standard band and shortwave broadcasting facilities, while continuing as assistant to the vice-president, radio and X-ray divisions.

•

▶ WILLIAM M. EMERSON, for ten years superintendent of the Portland, Ind., city light and power plant, has been named personnel director of the Indiana State Highway department.

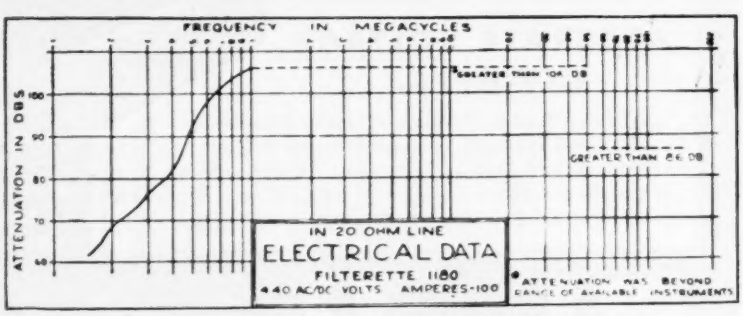
AWAY AHEAD!

Tobe Leads the Noise Elimination Field

FEW problems are as vexing as the elimination of unwanted radio interference set up by the operation of nearby electric motors. And few sources of engineering advice on this subject are as experienced as the Tobe Engineering Staff. *Tobe is the acknowledged leader in this field;* our organization has devoted 17 years to the intricate problems of noise elimination.

The large #1180 Navy-Type Filter illustrated above is an example of our specialization. Examine the curve and container dimensions. This is only one of a large number of filters designed to meet special needs. Send for complete details. Let us help you solve any problem connected with blotting out unwanted "man-made" radio static. Your inquiries are welcome.

TOBE DEUTSCHMANN CORP., CANTON, MASS.

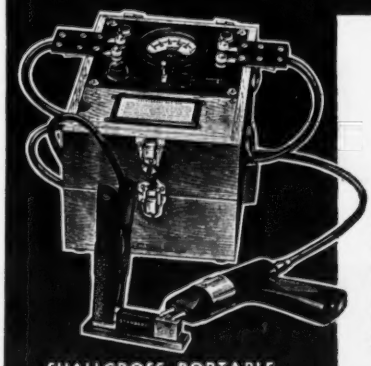


ATTENUATION RANGE 150 KC TO 150 MC
Navy-Type No. CTD 53177

SUPPRESS MAN-MADE RADIO STATIC
TOBE
FILTERIZED

CONTAINER DIMENSIONS

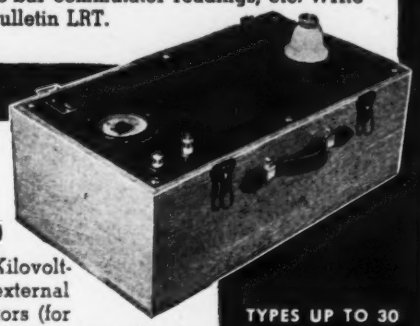
Length	10 1/8"	Height	3 11/16"
Width	3 3/4"	Overall length	13 1/8"



SHALLCROSS PORTABLE TYPE 645 FOR FIELD INSPECTION WORK

STREAMLINING LOW RESISTANCE MEASUREMENTS

Are you required to make hundreds of accurate "Go, No-Go" low resistance measurements? The Shallcross Portable Low-Resistance Test Sets are ideal for making rapid measurements in bond testing, switch and relay contact resistance testing, bar-to-bar commutator readings, etc. Write for Bulletin LRT.



HIGH-VOLTAGE MEASUREMENT PROBLEMS SOLVED

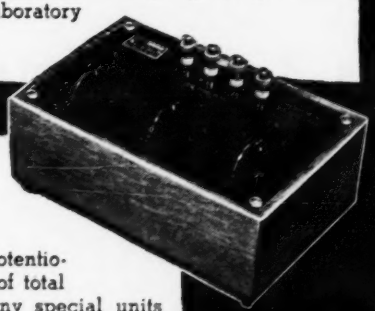
Shallcross Portable Kilovoltmeters, Kilovoltmeter Multipliers (for use with external meters) and Corona Protected Resistors (for voltages up to 200 KV) comprise a complete line of high-voltage measuring apparatus. Over a period of years Shallcross engineers have pioneered in the field of modern high-voltage measurements. They will welcome an opportunity to put their experience to work on your problem.

TYPES UP TO 30 KV AVAILABLE FOR RAPID DELIVERY!

TYPE 638-2 COMBINED KELVIN AND WHEATSTONE BRIDGE

ONE BRIDGE THAT DOES THE WORK OF TWO

Combining both Kelvin and Wheatstone bridges, this popular Shallcross instrument provides a resistance measurement range from 0.0001 to 11.11 megohms in a single portable instrument. Just the thing for maintenance, production line tests, field investigations, school and laboratory work, etc.



ACCURATE VOLTAGE DIVIDERS

Shallcross Voltage Dividers (Decade Potentiometers) are available in a wide range of total resistance and voltage increments. Many special units regularly produced for special applications. Write for latest data bulletins on any Shallcross instrument type.

TYPE NO. 845 POPULAR 3-DECADE UNIT

Shallcross

MANUFACTURING COMPANY

DEPT. EW-35, COLLINGDALE, PA.

ENGINEERING • DESIGNING • MANUFACTURING

OBITUARY

► BERTRAM T. MCBAIN, purchasing agent for the Portland General Electric Co., Portland, Ore., died suddenly on March 2 at his home in that city in his sixty-fifth year. In addition to his utility connection, Mr. McBain had wide interests in paper and pulp mills. He had acted as tax expert for the Portland Electric Power Co. and had been a member of the Oregon Tax Commission in 1937. He joined the Portland utility in 1930.

► THOMAS T. RICHARDS, for many years a vice-president and sales manager for the Wagner Electric Corp., St. Louis, died February 18 at his home in that city following a long illness. Mr. Richards was born in St. Louis, Mo., in 1871, and after taking an engineering course at Washington University, he spent two years in the plant of the Emerson Electric Manufacturing Co., of which he later became a vice-president. It was in 1905 that he joined Wagner Electric's sales department and after several promotions was selected for the sales managership. In 1923 he became vice-president and manager of sales, relinquishing the duties of this position three years later to become identified with the structural-steel building industry. Mr. Richards was 74 years of age.

► GEORGE A. SAUNDERS, formerly in the electrical engineering department of the Ontario Hydro-Electric Power Commission, died on March 5 at his home in Toronto, following a stroke. Mr. Saunders was 69 years old. He had recently retired after serving for 33 years with the commission, where he was in charge of distribution station design. Mr. Saunders was a native of Petrolia, Ont., and a graduate of the University of Toronto. He had been identified with the General Electric Co. and the Westinghouse Electric & Manufacturing Co. before joining the commission staff.

► ROBERT PAYNE, who in 1942 had served the electrical industry for 50 years and received the Golden Jubilee Award of the Minnesota Electrical Council, died at his home in St. Paul on January 4 after a long illness. Mr. Payne started in the electrical industry as a helper in the power plant at Winnetka, Ill., in 1892 and by successive promotions rose to the position of plant superintendent. When the company was merged with others serving the suburban area north of Chicago, Mr. Payne joined Northwest Equipment Co. of Duluth as a salesman. Later he became manager of the appliance department of the General Electric Sup-

WARD
LA FRANCE

THE FINEST HEAVY-DUTY TRUCKS MONEY CAN BUY

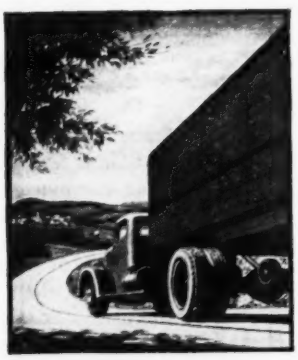
For over twenty-five years, Ward LaFrance has been building a traditionally fine line of heavy-duty motor trucks. Each successive year has brought advances in design and engineering. Today's Ward LaFrance is better than ever.

The finest Ward LaFrance trucks ever built are now serving the United Nations all over the world. They are the huge, type M-1 Heavy Duty Wreckers which have compiled an unbeatable record for stamina and dependability.

Postwar Ward LaFrance trucks and over-the-road tractors, both gasoline and Diesel, offer fleet owners the opportunity for the most efficient hauling in trucking history . . . Write our Sales Department for the Ward LaFrance fleet-owner plan.

FRANCHISES AVAILABLE

Progressive, merchandising-minded concerns eager to expand their profit possibilities by broadening their market potentials, would do well to consider the fertile, heavy-duty truck market. Investigate the profit potential in the Ward LaFrance line . . . Our Sales Department will be happy to supply information about available franchises.



WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC.

ELMIRA, NEW YORK

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

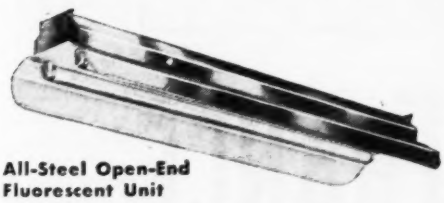
Scraping Dept. Gould & Eberhardt, Inc., Irvington, N.J.

"Day Shift" production around the clock!

When you give workers *Skilled Lighting* . . . the product of Wheeler's advanced engineering . . . you improve morale, bring daylight speed and accuracy to the job 24 hours a day!

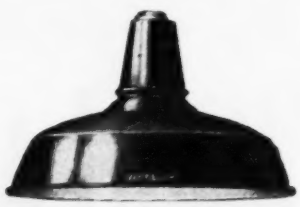
That's one big reason why it's important to install Wheeler Reflectors – product of 64 years of specialized light engineering. Wheeler Units are engineered to provide maximum light from standard lamps. Their high reflection factor puts light to work where it belongs – on the job. Made of heavy gauge metal, coated with vitreous enamel, their rugged construction insures long service, easy maintenance.

Learn how these better-engineered units can bring *Skilled Lighting* to your production scheme. Send for catalogs showing complete line of incandescent and fluorescent fixtures. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Also New York. Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuou runs.



RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

ply Corp. In 1928 he retired, but when the call came for electrical workers to rush construction on the Twin City Ordnance Plant, he took a job with the Commonwealth Electric Co. of St. Paul and remained active until his health began to fail a year ago.

► HUGH A. BROWN, professor of electrical engineering, University of Illinois, died on February 25 in Urbana, Ill., after a long illness. He was 55 years of age. Professor Brown instituted and developed the courses in radio engineering at the university and designed and put into operation the first radio broadcasting station licensed to operate at the university. He had also done work for the General Electric Co. and for the Illinois Traction System. Born in Cedar Springs, Pa., Professor Brown received his engineering education at the University of Illinois and taught at the University of Kansas and on the staff of Pennsylvania State College, before entering the electrical engineering department of the University of Illinois. He was a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Society for the Promotion of Engineering Education.

► EUGENE D. MONTGOMERY, assistant manager of the rate department of the Arkansas Power & Light Co., Little Rock, Ark., died on February 15 in a local hospital at the age of 44. Mr. Montgomery became associated with the power company in Little Rock in 1928 and had been assistant rate manager since 1941.

► EDMUND E. WALKER, light and power sales manager, B. C. Electric Railway Co., Vancouver, B. C., died recently at his home in that city. Mr. Walker had been head of the light and power department since his arrival from England in 1914 and was chairman of the Electrical Service League since its inception in 1920. He was responsible for the standardization of the B. C. Electric light and power rates.

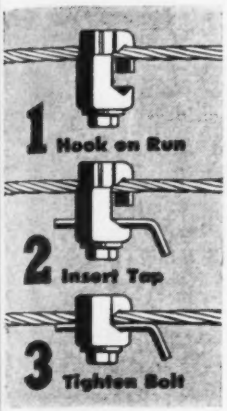
► CHARLES V. DEWAR, founder and owner of the Midwest Electric Manufacturing Co., died on January 24 of a heart ailment. He was 62 years of age. Born in Solomon, Kan., Mr. Dewar founded the company in 1914.

► GEORGE A. STILES, who had been connected for 38 years with central Ohio utility companies, died on February 26 in Columbus. For three years prior to his retirement he was superintendent of maintenance with the Ohio Midland Power & Light Co., and previously spent ten years with the Valley Public Service Co. and 25 years with the old Scioto Valley Traction Co.

ONE-PIECE VISE-TYPE CONNECTORS

SAVE MAN HOURS • REDUCE SERVICE INTERRUPTIONS

Why FARGO solderless connectors are easy and safe to handle, permanently vibration-proof and produce high conductivity at contact point



EASY AND SAFE TO USE

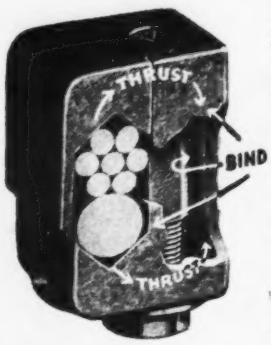
One-piece construction—always threaded—no time lost starting a nut—no chance of cross threading—no loose parts to lose.

Safer to use on hot lines. Bolt tightens with short, easy twist of the wrist; no arm or shoulder swing needed.

Any standard wrench will fit. Only two bolt head sizes (3/8" and 9/16") for 8 sizes of Fargo Connectors, handling wires from No. 8 Solid to 4/0 Strand.

Bolt removable — convenient in making grounds and additional taps.

GRIPS LIKE A VISE



1. High pressure at wire contact point develops terrific *vibration-proof bind* from inside thrust.

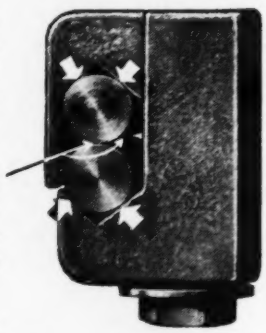
2. Small bolt, forged and rolled for extra strength, with precise, deep-rolled threads, means easy turning and high compression without stripping. Gives you not less than 10 lbs. compression between conductors for every inch-pound of wrench pressure. *They'll take all the torque a lineman can apply, unless he's out with an oversize wrench, intent upon destruction!*

HIGH CONDUCTIVITY—LOW VOLTAGE DROP

1. The V-Groove jaw construction guarantees four points of contact with the Connector (see arrows) plus the wire-to-wire contact along a wide clamping area.

2. The tremendously high compression, obtainable even with low turning force, can produce a slight flattening of wires at point of contact, thus improving the conductivity.

3. The *massiveness* of the sturdy Fargo body helps carry current under overload conditions.



(Approved by Underwriters' Laboratories, Inc.)

Durable — Dependable — Re-Usable

Fargo Connector bodies and bolts stand up under extreme conditions . . . *climatic, mechanical, chemical* and *electrical*. Bodies are made of a tough copper-silicon-manganese alloy with a copper content of 96%. Bolts are made of a high strength copper-tin-silicon alloy with a copper content of 98%. Each metal was adopted as best for its specific purpose, after thorough tests over a long period.

These features, which produce durability and dependability, also mean high salvage value.

Fargo connectors available in sizes No. 8 solid to 1,000,000 CM.

For free catalog, application data and current information regarding speed of delivery, write or call any Line Material Company representative.

All Fargo products distributed by

LINE MATERIAL COMPANY

Milwaukee, Wisconsin.

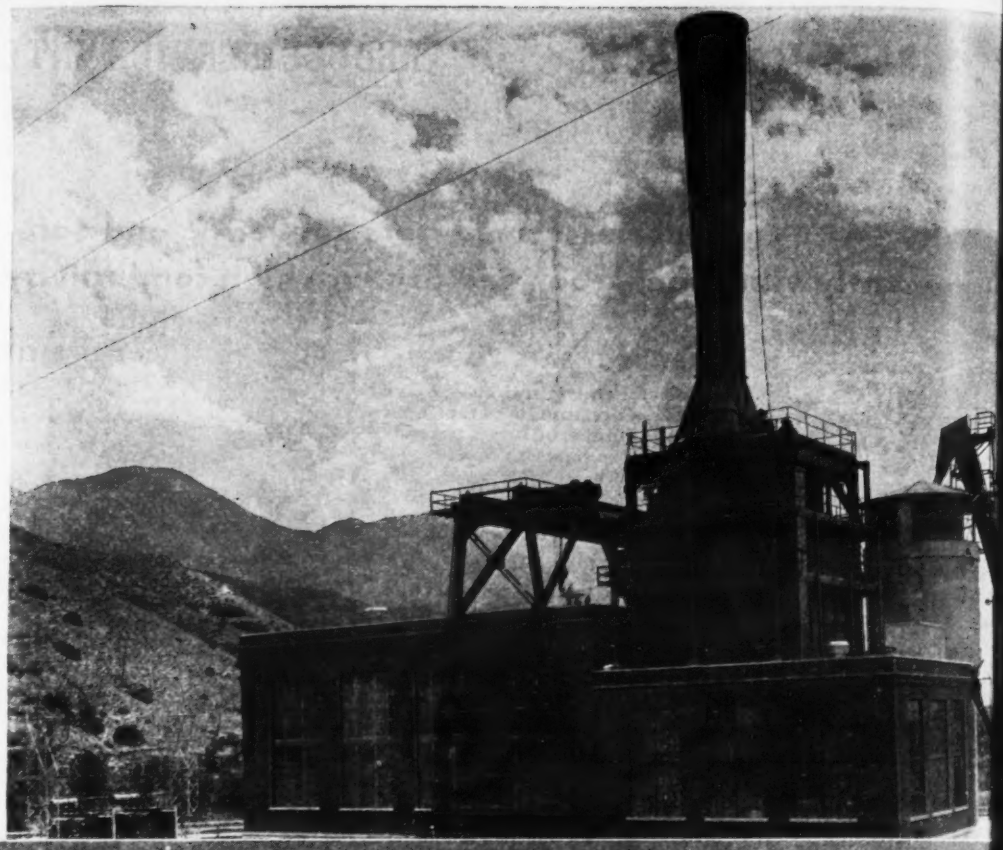
(*Representatives in principal cities*)

FARGO MFG. COMPANY POUGHKEEPSIE, NEW YORK

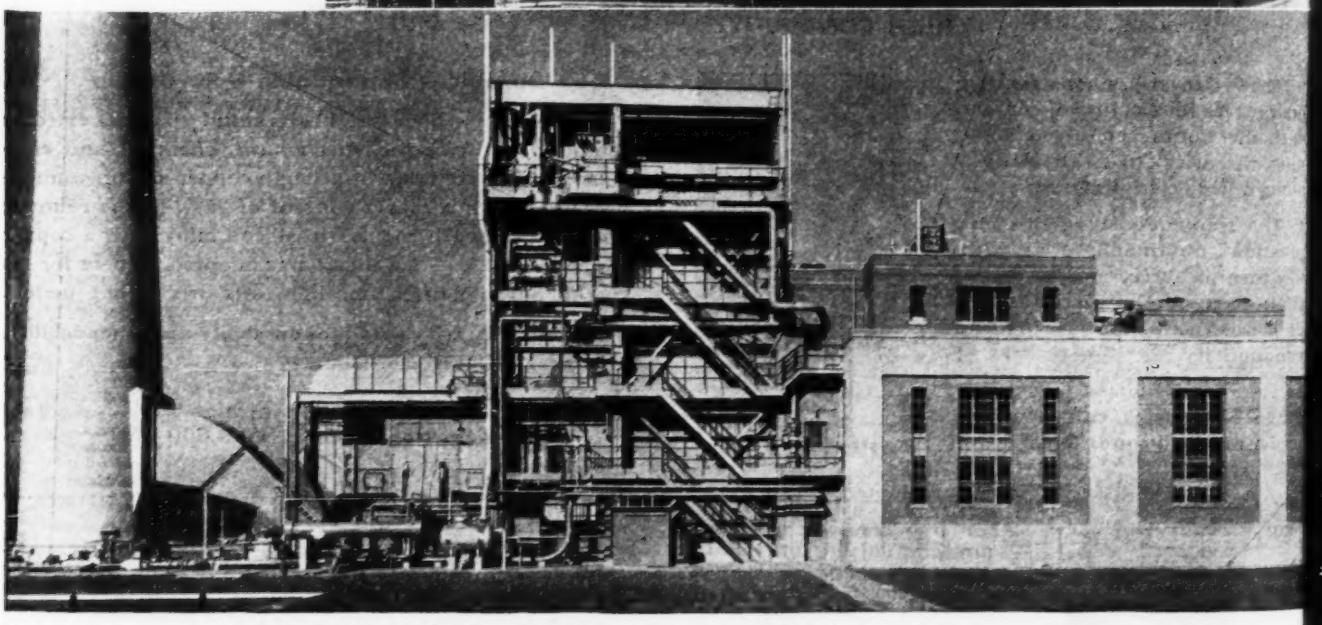
ESTABLISHED 1914

SOLDERLESS CONNECTORS • LINE SPLICES • ELECTRICAL SPECIALTIES

C-E *"Outdoor"* BOILER



This plant, located in the West, is subject to severe climatic conditions. Its elevation is above 4000 ft. and sub-zero temperatures are common in winter months. Boiler capacity — 200,000 lb steam per hr; Design Pressure — 450 psi; Total Temp. — 760 F. Fired by Chain Grate Stoker.



This plant is in the Southwest. Climate is moderate. Boiler capacity — 350,000 lb steam per hr; Design Press. — 800 psi; Total Temp. — 830 F. Fired with natural gas and oil.

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND A

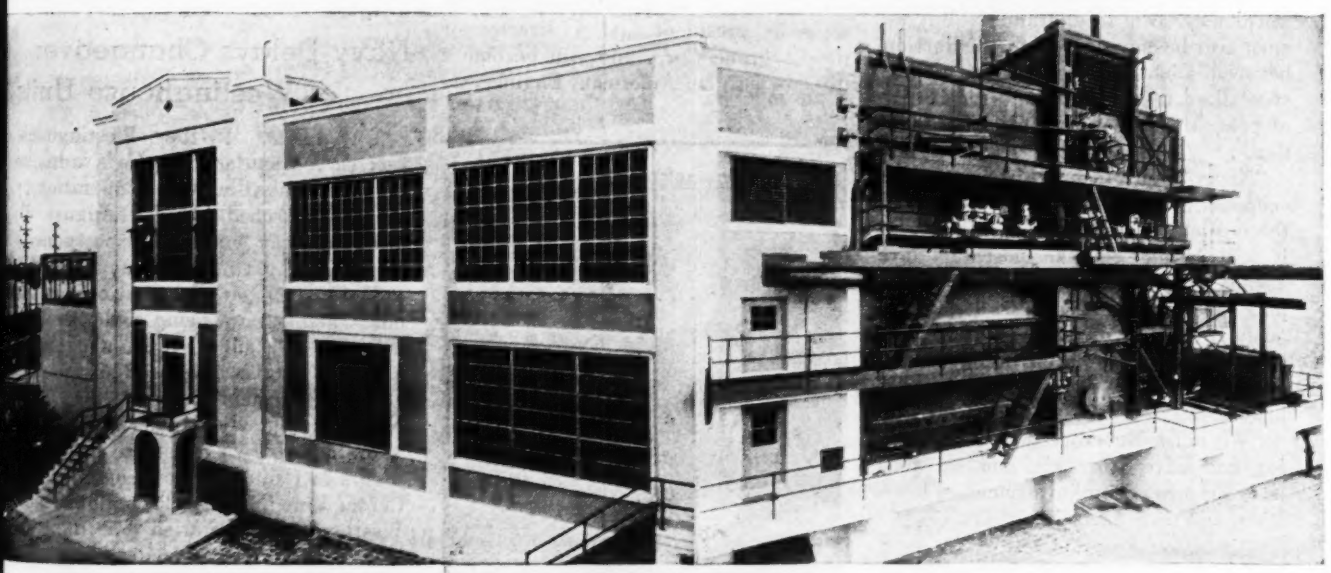
IN UTILITY PLANTS

FOR some years there has been a growing interest in the so-called "Outdoor" plant by the utilities. This type of plant has attractive economic possibilities that merit consideration — particularly where a mild climatic situation prevails. Experience has shown savings of $3 to $5 per Kw of installed capacity.

Combustion Engineering has been associated with this work virtually since its inception, having installed one of the earliest utility installations of this kind nearly ten years ago. This unit is shown in the upper view on the opposite page. The other illustrated utility units are more recent, the one below having been placed in service during 1942 and the unit at the bottom of the opposite page having seen its first year of service during 1944. All have proved very satisfactory.

In addition to its utility installations Combustion Engineering has supplied a great many outdoor and semi-outdoor steam generating units for industrial plants, particularly in refineries where it is common practice to operate equipment in the open without building protection.

As a result of its broad experience with the problems peculiar to this type of installation Combustion Engineering is qualified to be especially helpful to utilities interested in outdoor plants. A-864



This plant is in the South. Climate is mild. Boiler capacity — 300,000 lb steam per hr; Design Press. — 1000 psi; Total Temp. — 905 F. Fired with oil.

ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

MANUFACTURING MARKETS

Foresees Difficult Selling Post-War

Warning against indifference and over-confidence with respect to post-war economic problems, Charles B. Brown, advertising director of RCA Victor, predicted that American business after the war will face "the toughest selling job it has ever known.

Addressing a luncheon of the Rotary Club in El Paso, Tex., Mr. Brown asserted that the full production program recognized as vital to a sound and prosperous peace can only be achieved through "an efficient productive advertising and sales program which will move billions of dollars in merchandise at a reasonable profit to all concerned, from worker to investor."

"When we review the great strides of science during the past few years," he said, "we are tempted to feel slightly heady about the triumphant post-war world they seem to guarantee. But we must ever be conscious of the distinction between scientific development for the specialized tasks of war and the reality of peace-time reconversion and production.

"Never before in our history has the economic problem been as complex and the burden on management as heavy as it will become in the post-war days ahead. American industry must produce and salesmen must sell continuously a volume of goods beyond anything that has ever been produced and sold before in America's peacetime history.

"We must use every tool in the selling and advertising kit, and we must base our advertising investment on facts, facts, and more facts."

•

Sees Increased Output of Lear Equipment

A sizable increase in production of Lear electrical-mechanical controls for aircraft was foreseen for the coming year, William P. Lear, president of Lear, Inc., recently stated.

"Our plants in Piqua, Ohio, and Grand Rapids, Mich., are now working at capacity in the production of actuators, flexible shafting, power units and communications systems," he said, "but the increased production of aircraft announced for the next schedule will mean even greater demands on our facilities. . ."

Increased schedules on planes carrying Lear equipment include the P-47 Thunderbolt, A-26 Invader, B-24 Liberator, C-82 Packet and the well known C-46 Commando.

•

American Engineering Co. Buys Cochrane, Faraday

American Engineering Co. has concluded negotiations for the acquisition of the entire outstanding stock of Cochrane Corp., Philadelphia, Pa., and the Faraday Electric Corp., Adrian, Mich.

Both companies will be operated as subsidiaries of American Engineering Co. Percy S. Lyon will continue to serve as president and a director of the Cochrane Corp. and will become a director of the American Engineering Co.

MANUFACTURERS' REPRESENTATIVE —George B. Cumming, right, general secretary of NEMA, checks his script with Lyle DeMoss, producer of the Union Pacific Railroad's "Your America" network show, before going on the air on March 4 in a program which was a salute to the nation's electrical manufacturers

Manufacturers Make Sales Assignments

Among the electrical and allied manufacturing companies making recent appointments to their sales staffs are the following:

COPPERFIELD STEEL CO. has announced that Capt. John J. Healy, who has been with the Army Air Forces for the past 33 months, has been assigned to inactive duty and is back as northwest representative. He will be under the jurisdiction of Copperweld's Chicago office and will cover the states of Minnesota, North and South Dakota, Montana, the Upper Peninsula of Michigan and the northern portion of Wisconsin—the territory he covered prior to his enlistment.

ELECTRIC STORAGE BATTERY CO., Philadelphia, has named J. A. Cronk manager of its Atlanta branch, to succeed Mark C. Pope, Jr.

STANDARD TRANSFORMER CO., Warren, Ohio, has appointed A. P. Dearing of Dearing & Co., Youngstown, Ohio, its sales representative. His territory includes Trumbull, Mahoning, Columbiana counties in Ohio, as well as Mercer and Lawrence counties in Pennsylvania.

WESTINGHOUSE ELECTRIC SUPPLY CO. has appointed John F. Myers Middle Atlantic District manager to succeed H. M. Gansman, who will retire after almost 41 years of service with Westinghouse. H. C. Lease has been named manager of the Washington (D. C.) branch to succeed Mr. Myers.

ROYAL ELECTRIC MFG. CO. has recently announced the appointment of John W. Clarke Co. as its representatives in most of the territory in and around Chicago.

•

Navy Delays Changeover of Westinghouse Units

Conversion of the Westinghouse Electric & Manufacturing Co.'s ordnance plant in Louisville, Ky., to operation by the Navy, scheduled for August 31, 1945, has been "indefinitely postponed," the Navy Department has announced.

The conversion of operations at two other plants now being run by Westinghouse at Canton, Ohio, and Center Line, Mich., also have been postponed.

"By agreement between the U. S. Navy and the Westinghouse Electric & Manufacturing Co., three ordnance plants in Canton, Ohio; Louisville and Center Line, Mich., will continue under Westinghouse operation for the time being," the Navy's announcement said.

•

Army-Navy "E" Awards

The third Army-Navy "E" Award has been presented to the McCabe-Powers Auto Body Co., St. Louis, Mo. Among other recent recipients of the "E" award are the Cole Electric Products Co., Long Island City, and General Cable Corp., Buffalo and St. Louis plants.

CONTINENTAL DIAMOND

ENGINEERED *Electrical Insulating Materials*

Many of the advances made in Electronics for War Radio, Radar, Communications and Control equipment will be incorporated in home and auto radio broadcasting and reception. C-D has developed many new grades of its standard Engineered Electrical Insulating Materials to meet the requirements of these engineering advances.

The part shown is a grade CE DILECTO punching. It met the engineering specifications calling for a high dielectric, strong enough to mount current carrying parts, and resist severe impact and vibration.

KF-45

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

The C-D technicians who have worked to develop better Dielectrics to meet War's severe requirements, are now ready to help you solve your electrical insulating problems. Their familiarity with 6 distinctly different types of electrical insulating materials assures you of unbiased recommendations.

DISTRICT OFFICES

NEW YORK 17 • CLEVELAND 14 • CHICAGO 11
SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES

•

WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

•

IN CANADA:
DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

COMPLETE INFORMATION ON CABLE PROTECTION

IF YOU HAVEN'T A COPY—SEND FOR ONE TODAY

Complete with illustrations, tables and graphs, this new catalog shows why and how Orangeburg Conduit provides sure protection to cable sheath from abrasion and corrosion, pulling tension, ground water infiltration. Describes approved methods for underground installation of electrical conduit with or without concrete encasement. Explains methods of joining and field tooling. Furnishes full data on fittings and other practical material. All in all, *the book of the year* on underground cable protection. Send for Catalog No. 49 today!

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.
GRAYBAR ELECTRIC CO., INC. *Distributors* GENERAL ELECTRIC SUPPLY CORP.

ORANGEBURG FIBRE CONDUIT

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

OPA Allows Mark-Up on Poles for Resale

The Office of Price Administration has authorized distributors of Northern white cedar poles to use a 20 percent mark-up in sales to other distributors for resale.

In raising the distributor-to-distributor markup from 15 to 20 percent and putting it on a level with distributor-to-consumer markups, OPA ordered that the markup be used only once, and that any increase in purchase price to a distributor must be absorbed by him.

The move was aimed at facilitating inter-distributor transfers by allowing the selling distributor to receive as much as he would have by selling his poles to an ultimate user. Due to the large demand for poles, the machinery whereby one distributor would help another fill an order was breaking down under the disparity between prices received in distributor-to-distributor sales and those received in distributor-to-consumer sales.

•

War Contracts Center Opened by Army-Navy

A joint Army-Navy distribution center has been established at 90 Church Street, New York, to distribute the Joint Army-Navy Termination Regulation together with other printed material pertaining to contract settlement. A recent survey has disclosed that less than 40 percent of the war contractors circularized had availed themselves of this publication.

In a release issued by the War Department and the Navy Department it was stated that "it is imperative that contractors holding war contracts be placed on the mailing list for the Regulation and all subsequent changes."

•

NAM's 50th Anniversary

Announcement has been made by the National Association of Manufacturers that its 360 charter member companies would be awarded special certificates in commemoration of their founding of the association half a century ago in Cincinnati. Sixty-five of these companies are located in New York City.

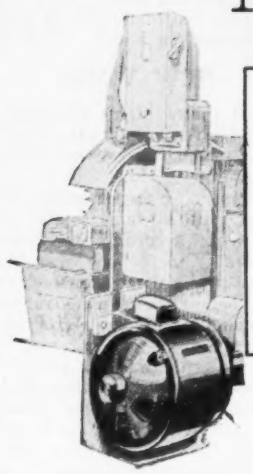
•

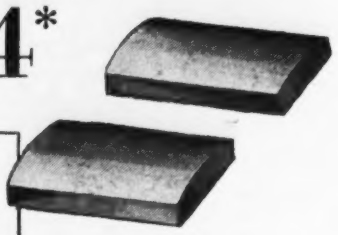
G.E. Making Jet Engines

Production of jet engines for Army Air Force combat planes including the new P-80 is underway on a volume schedule at the General Electric Co. Syracuse plant.

A Fine Example of Versatile Contact Material

MALLORY D-54*





TYPICAL PHYSICAL PROPERTIES
(Annealed)

Conductivity %IACS	75-85
Hardness (Rockwell)	35-45 F
Tensile Strength PSI	16,000
Density Grams per CC	9.6-9.8
Density Tr. Oz. Per In.^{3}	5.07-5.17

AN electrical contact material must have versatility to be specified by design engineers for many electrical contact applications. The complete versatility of Mallory D-54 contacts is demonstrated by their use in a broad range of voltage and current applications. This heavy-duty, current carrying contact material offers all of the many unusual mechanical and electrical advantages of silver and cadmium oxide.

Mallory D-54 is also adaptable to the main contact of heavy-duty circuit breakers where occasional arcing proves so destructive to silver contacts.

One manufacturer of motor-starting controls uses Mallory D-54 contacts to carry and interrupt a 600-ampere maximum load—100-ampere normal load—with a maximum operating voltage of 460 volts AC. Another application requires contacts of this material to close on inrush currents of 2,400 amperes at 28 volts DC.

Still another manufacturer has bought in the last year over 1,150,000 pieces of Mallory D-54 for fifteen different applications. Mallory D-54 has been tried—and not found wanting.

Mallory Manufactures Contacts for Every Application

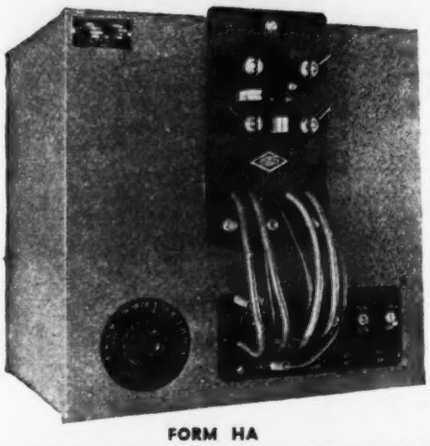
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

**Trade Mark*

ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES

TEST TABLES

For Testing **Watthour Meters, Demand Meters, Relays and Transformers**



FORM HA

Capacity 75 amperes, 120-240 V., For bottom terminal and socket type meters.
May be set up on Bench or Table, or in Car or Truck.

STATES TESTING EQUIPMENT

FORM FA

Capacity 75 and 150 ampere, inclined panel, dead front switches.
Carefully designed for efficient operation.

FORM FRD

Photo-Electric Equipped Test Table. For Details See Cat. 1 Sec. 3, and Sheet 193B2.

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THE STATES COMPANY, Hartford, Conn.
Please send details on Test Tables.
Name ..... Title .....
Firm .....
City .....
State .....

Field Reports on Business

Industrial production continues to move steadily upward with output of critical war material close to peak levels. Utility construction in certain areas has taken a spurt in recent weeks, projects including generating stations, transmission lines and substations. Orders include considerable line construction material.

CHICAGO

Immediate outlook for the heavy construction industry in the midwest is not considered favorable by the Federal Reserve Bank of Chicago for several reasons: (1) Nearly all of the vast wartime construction program has been completed except for some additional plants and allied housing; (2) manpower shortages limit construction activity, particularly in view of the required WPB approval of all civilian and military building in acute labor shortage areas and (3) in the light of these conditions numerous related wartime priority and conservation regulations are certain to remain in force until at least some time after V-E day.

Exception to the above evaluation of construction activity would appear to be projects involving extensions of utility generating stations, transmission lines and substations, of which several have been announced recently, and on which work will be begun in the immediate future. Utility construction in this area appears to have taken on new life in the past six weeks judging from the number of new projects announced and the reports of manufacturers.

Plans have been approved and announced recently by the War Department for expansion in ammunition loading facilities at the Hoosier Ordnance Plant. The project calls for a number of new buildings with machinery and electrical equipment necessary for a considerable increase in capacity. Cost is estimated at $1,400,000.

Among the new announced post-war plans is one of the Pullman Standard Car Mfg. Co., Chicago, for the modernization and expansion of several plants in various parts of the country. New buildings, machinery, electrical equipment and other facilities for increased production of new models of Pullman and standard railway cars are contemplated. Cost of the modernization is estimated at $6,000,000.

Commonwealth Edison Co. estimates that the reduction in its kilowatt-hour sales as a result of the "brownout" is approximately 2 percent.

PACIFIC COAST

Latest building permit totals for the seven western states show an overall 30 percent decrease from last year, attributable to California and Oregon. Washington is 40 percent over last year and Arizona, Idaho, Nevada, and Utah register increases.

Orders include considerable line construction material such as poles and cross arms for California utilities and regularly scheduled shipments of fluorescent fixtures for relighting overseas bases. Sheet metal curtailments have considerably lengthened deliveries of service cans and wiring troughs from Pacific Coast manufacturers. The multiple-purpose hanging Horse Dam projects in northwestern Montana is now under final preconstruction survey. A 500 ft. dam support for 142,000 kw. is planned.

New major government construction includes a $2,500,000 naval depot at Torrance, southern California, for salvaging battle-damaged radio and electronic material.

A $100,000 electrical contract is expected to cover partial reconversion of basic aluminum plant at Las Vegas, Nev., to shell casing processing. Orders include 1800 fractional horsepower motors for pressure pump service; two 44-ton diesel electric locomotives, costing $100,000 for a Central Valley electric railroad; and a 5,000 kva. auto transformer for Pacific Gas & Electric.

NEW YORK

Orders at many plants continue at exceptionally high levels as war schedules are raised. In recent weeks employment and payrolls have increased.

Civil engineering construction volume in continental United States totaled $41,893,000 last week, according to *Engineering News-Record*. This volume was 7 percent higher than in the preceding week, but was 6 percent below the volume reported for the corresponding 1944 week. Private construction gained 319 percent over the preceding week, and was 83 percent above the 1944 week due to the increased industrial building activity. The week's construction brough 1945 volume to $278,584,000 for the ten-week period, a decrease of 22 percent from the $358,586,000 reported at this time last year.

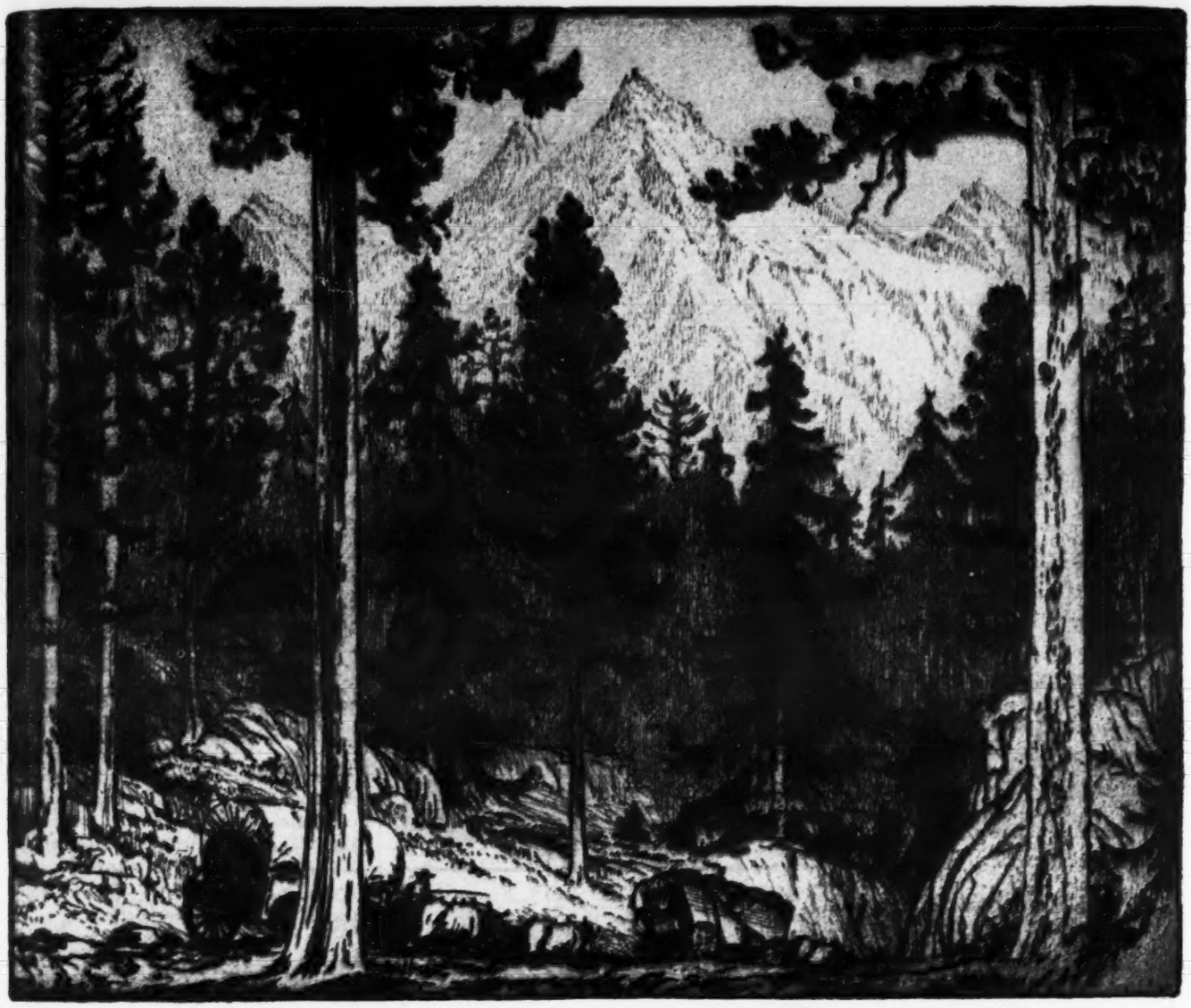
Retail trade in the Metropolitan area continued active last week, with buying of new spring apparel and accessories the outstanding feature. Department store volume was estimated as running more than 20 percent ahead of the similar week of 1944.

NEW ENGLAND

Connecticut manufacturers are planning large-scale factory additions. Recent DFC allocations include $2,600,000 to Scovill Manufacturing Co., Waterbury; $9,800,000 to Chase Brass & Copper, Waterbury; and $6,300,000 to Pratt & Whitney Aircraft, East Hartford, for its Kansas City (Mo.) plant. New England Telephone & Telegraph expended in 1944 $8,400,000 on new construction, nearly all for war and related facilities.

Inquiries for electric heat-treating furnaces are encouraging. One representative sold three salt-bath furnaces this month rated 30 and 40 kw., making a total of five furnaces sold during the past two months to munitions plants in this district. Pullman Standard Car Mfg. Co., Worcester, Mass., will begin turning out new types of club cars as soon as war restrictions are removed. This company reports orders for several hundred cars on hand. Concord, Mass., has $50,000 for underground electric lines construction, and Stoughton, Mass., is shaping plans for remodeling its town hall and for constructing an addition and recreation ground for its high school. The Walter Baker Co., Dorchester, Mass., will build a 5-story warehouse.

Navy schedules are calling for large numbers of capacitors of various types and New England manufacturers are active bidders. A Boston manufacturer had submitted bids on 4,200 electric hot plates; radar orders are well sustained and wiring supplies are moving steadily toward shipyards where a good deal of repair work is going on. The regional office of Surplus Property, Boston, has asked for bids for 23,355 electric buzzers. For the first time in many months a leading Boston department store offers for sale small lots of a variety of electrical appliances.



VIRGIN FORESTS—

In the early days of our country it was necessary for early settlers
to slash their way through virgin forests. Some of these
tree specimens can today be seen along highways.
Beautiful trees along the highways and streets
have always been considered a birthright of our people.
Where it is necessary for power and communication lines to pass through these trees,
the proper trimming of them
can tremendously increase the good will of the public
toward Utility Companies.
The Asplundh Tree Expert Company has been engaged exclusively since 1928
in providing this type of tree trimming service to many Utility Companies.
The good will resulting from these operations
has seen a steady growth in the number of our clients.

ASPLUNDH TREE EXPERT CO.
JENKINTOWN • PENNSYLVANIA

A HOIST TO FIT THE JOB

This Signal Corps picture, taken somewhere in France, shows U. S. Army Engineers using a Coffing "Safety-Pull" hoist in the construction of a treadway bridge.

Every day brings the war nearer to a successful conclusion and Coffing Hoists are doing their part, both on the war front and the home front.

Whether in mills, factories, mines, utilities, oil fields, construction, production or maintenance there is a Coffing Hoist that will help you do the job faster, better and more economically. Write for Catalog No. E-G-6.

COFFING HOIST COMPANY

RATCHET LEVER HOISTS - SPUR GEAR HOISTS - ELECTRIC HOISTS
LOAD BINDERS - DIFFERENTIAL HOISTS - TROLLEYS

DANVILLE, ILLINOIS

Short Cuts

TO GREATER PRODUCTION

TRICO

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"Powder-Packed" Time-lag

RENEWABLE FUSES

Designed to meet the demands of engineers for a renewable fuse equipped with a "different" link—a link that is safe, tamper-proof, non-interchangeable and embodying a reasonable time-lag—not overdone.

In TRICO you get everything, plus the assurance that only the correct size can be used—no chance for unsafe, inefficient performance. That's why TRICO gives dependable, trouble-free protection with THREE TIMES THE SERVICE.

Write for Bulletin #1

KLIPLOK CLAMPS

That jack-screw pressure literally bolts fuses and clips together, eliminating

- Premature fuse blowings
- Unnecessary shut-downs;
- Needless repairs
- Burnt fuses and clips
- Arcing at contacts
- Wasted current

Ten sizes to fit popular types of fuse clips.

Write for Bulletin #6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Reliance Electric Sales Hit New High in 1944

Sales and deliveries of the Reliance Electric & Engineering Co., Cleveland, Ohio, reached the largest volume in the 39-year history of the company, Chairman Clarence L. Collens and President James W. Corey announced in the annual report for the year ended October 31, 1944 recently issued.

Deliveries of electric motors and associated equipment amounted to $17,876,935, an increase of $500,000 over the previous fiscal year. During the 12 months ended October 31, 1944, the company entered orders with a net aggregate value, after deduction for cancellations of $13,760,618.

Net profit for the fiscal year was $540,522 after provision for estimated Federal taxes of $1,940,000, depreciation and amortization of plant and equipment amounting to $199,903, and establisment of a revision for pensions and other contingencies of $200,000.

•

G. E. Output Is Centered on War, Says Wilson

Production of war weapons and equipment at an ever increasing tempo continues to be the No. 1 mission of the General Electric Co., Charles E. Wilson, president, stated in a recent report to stockholders, supplementing the usual financial report.

The report listed ten major war developments and production achievements of General Electric, including jet propulsion, B-29 central gunnery system, rocket launchers, X-rays, destroyer escorts, power for Navy, turbo-superchargers, instruments of some 280 varieties, motors and generators and communications equipment.

•

Home-Planning Booklet

Kelvinator Division, Nash-Kelvinator Corp., has issued a new booklet entitled "Home of Your Dreams". In full color, the 32-page booklet gives the home-planner original plans of the six most popular types of small homes, each one distinctive in style and livability. The new booklet ties in with current public interest in homes and kitchens.

•

Rome Cable to Pay Extra

An extra dividend of 25 cents and the regular quarterly dividend of 15 cents a share were voted on the common stock by Rome Cable Corp. for payment March 29. No extra was distributed in 1944.

Ruralductor came to stay.

By filling a definite need, this stranded steel conductor has proved itself during the war years. It will be doing a still bigger job in the era of peaceful tomorrows.

Comparative figures have proved beyond question that Ruralductor effects outstanding economies where secondary feeders and tap mileage predominate. Being of steel, Ruralductor possesses the strength that makes possible longer spans, hence a reduction in the number of pole structures needed.

That is the reason for its basic economy, since a non-ferrous line of equivalent strength would be unnecessarily costly for most rural mileage. Ruralductor's electrical capacity, while of course somewhat less than that of non-ferrous conductors, is entirely adequate for most farm districts not yet electrified.

As a protection against corrosion, Ruralductor is bethanized—guarded against corrosive action by a smooth, uniform zinc armor of high purity. The bethanizing process, used exclusively by Bethlehem, creates coatings in three different weights—A, B, and C. This is a distinct advantage, as it enables the user to select the proper coating weight for corrosive conditions in any given area.

Let a Bethlehem representative explain how Ruralductor will save money in farm-electrification programs. You'll find plenty of precedent for including it in both your present and postwar planning.

RURALDUCTOR

BETHLEHEM STEEL

GANGLAND IS AT IT AGAIN!

THOSE underworld saboteurs, RUST and CORROSION, are back . . . nibbling away at your iron and steel products. If you are wise, you'll beat these criminals to the draw . . . by using PENNizing, the nemesis of rust and corrosion. The PENNizing process of Quality Hot Dip Galvanizing is the ONLY sure way to guarantee long-lasting protection at an economical cost. Stop . . . look . . . let PENN show you the way!

PENNizing is the process of revitalizing your iron and steel products by Quality Hot Dip Galvanizing as perfected by the Penn Galvanizing Company since 1910.

HOT DIP GALVANIZING • GALVANIZED IRON AND STEEL PRODUCTS FURNISHED

PENN GALVANIZING CO. "the Nation's Largest"

PICKLING AND PAINTING • PICKLED AND PAINTED IRON AND STEEL PRODUCTS FURNISHED

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PLANTS: No. 1, 2201 E. Tioga St. - No. 2, 2400 E. Tioga St. - No. 3, 3548 N. Sepviva St.

Royal-ettes

7 in a series of informative news letters from a producer of Power Switching Equipment.

SWITCH BEARINGS

One of the most important parts of high voltage switchgear is the bearing. Several years ago our engineers decided to throw their best energies and experience into the design of the main bearing on our rotating type insulator switches. What they came up with was a new non-rusting, double-thrust bearing that will outlive any switch, and never needs to be greased. It uses ball bearings—for ease of switch operation—and both balls and races are of bronze—to avoid the need for greasing. The enclosure keeps out water—and ice. Both radial and thrust type loads are fully supported so there is no danger of rotary stack-sag when the switch is vertically mounted on the side of a structure. Although it costs a little more to do the job this way, service records of the many switches in use convince us that it is well worth it.

•

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

Sales Opportunities

CALIFORNIA—Southern California Edison Co., Los Angeles, has plans maturing for new steel tower transmission line from Boulder Dam hydroelectric generating station of government, about 130 miles, for increased power supply in Los Angeles area. Line will operate at 125,000 volts and is estimated to cost about $4,500,000, with switching stations and terminal substation facilities. Priority rating has been secured and work is scheduled to begin soon.

KANSAS—Lee Rubber & Tire Corp., Conshohocken, Pa., has contracted with government for construction and operation of new mill to be used for production of heavy-duty tires for army trucks and vehicles. Large tract of land has been selected. Main unit will be one-story, 330 by 900 ft., with several auxiliary structures. A power substation will be built, as well as boiler house and compressor station; also transformer stations in different parts of plant. Processing machinery and electrical equipment will be installed. Cost estimated close to $3,500,000, with financing by Defense Plant Corporation. Albert Kahn, Inc., New Center Bldg., Detroit, Mich., is architect and engineer. Erection will begin soon.

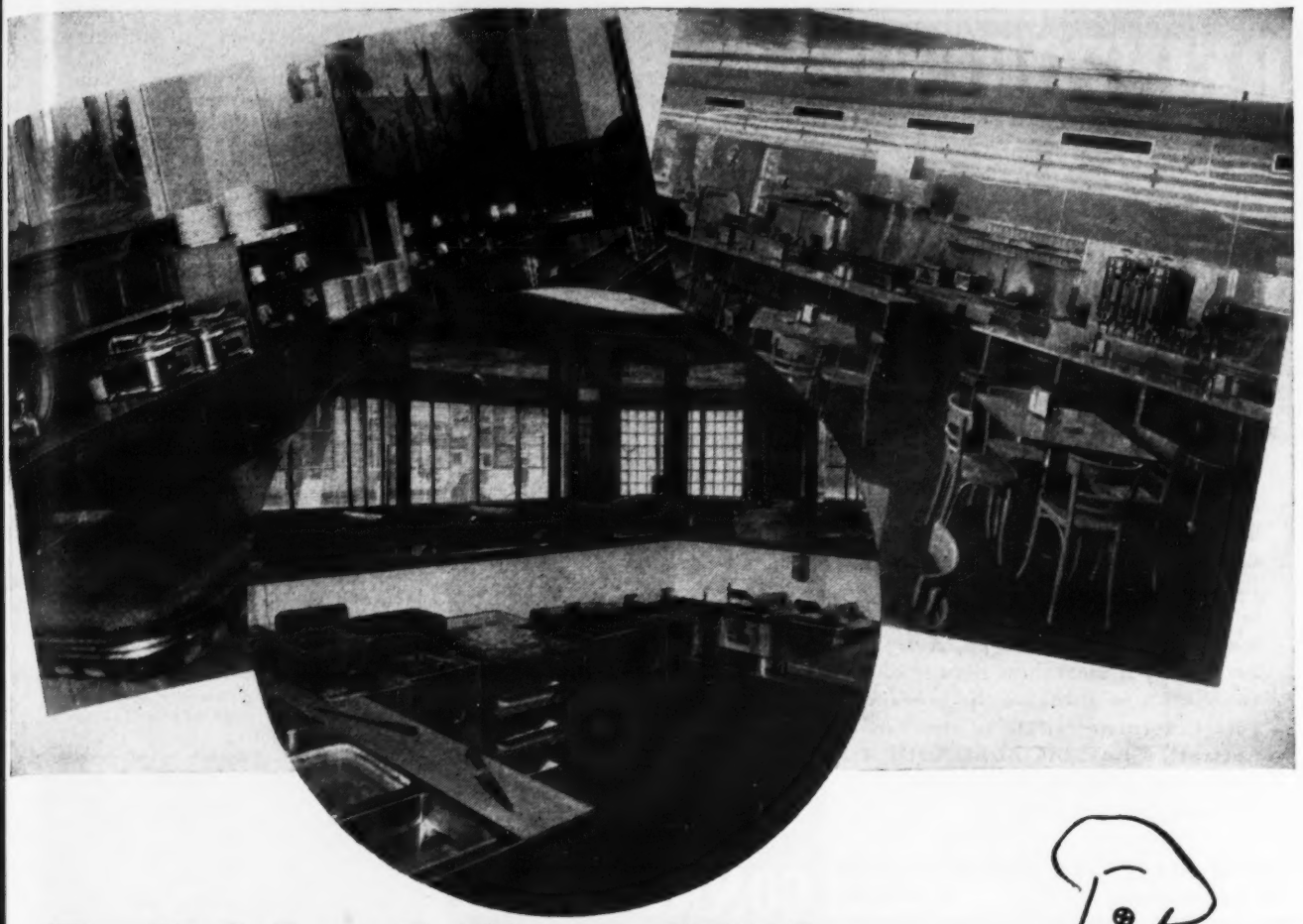
MISSISSIPPI—War Department, Washington, D. C., has authorized expansion in ordnance plant, comprising additional buildings and machinery and electrical equipment. Work is scheduled to begin at early date. Cost estimated at $2,040,000. Project will be carried out under direction of U. S. Engineers Office, Mobile, Ala.

TEXAS—Water and Light Department, Denton, plans post-war expansion in municipal power plant, and has had survey and report made by Joseph Ward & H. C. Sanders, Wichita Falls, consulting engineers. Recommendations include extension in station, and installation of new gas or diesel engine-driven generating unit and accessories, estimated to cost over $300,000; also new power substation and extensions in primary and secondary lines, to cost approximately $60,000, and addition to switchyard, with switchgear and other high-line facilities, to cost about $110,000. Report includes recommendations for later expansion in plant and system, estimated at $345,000.

CONNECTICUT—Scovill Mfg. Co., 99 Mill St., Waterbury, manufacturer of brass and other metal products, will carry out expansion in plant for production for government, including additional buildings, with machinery and electrical equipment. Cost about $2,600,000, with financing by Defense Plant Corporation. Work will be placed under way soon.

NEBRASKA—Water and Light Department, Lincoln, plans new cooling tower at municipal power plant and bids are scheduled to be asked at early date. Structure will be about 20 ft. high, and is reported to cost approximately $42,000. A priority rating has been secured.

IDAHO—Bureau of Reclamation, Denver, Colo., has preliminary plans for proposed Mountain Home Reclamation Project on North Fork of Payette River, and for which authority is expected to be granted by Congress at early date. Work will comprise a power dam on river noted, two tunnels for water diversion, three reservoirs, two hydro-

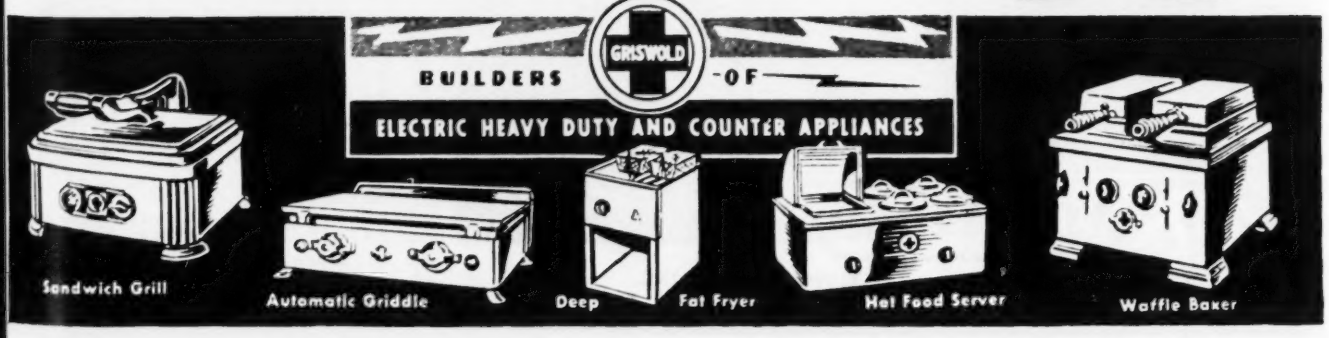


Build load Here With GRISWOLD ELECTRICAL COOKING EQUIPMENT

The modern tap room, snack bar, restaurant and coffee shop offer a market where a real load can be built dependably by the use of Griswold Back Bar, Counter, and Display Window Cooking Appliances. There is a Griswold man in your vicinity who will be glad to work with you in planning the layout and suggesting the necessary Griswold appliances in these many places of business catering to an ever-hungry public . . . As the time approaches when the tremendous loads of the present emergency gradually become lighter, utilities men are giving more and more thought to the requirements of hotels, restaurants, coffee shops . . . in fact, every spot where the public drops in for meals. There is no better field to cultivate right now. Let your Griswold man assist you in the effort.

THE GRISWOLD MFG. COMPANY - Erie, Pa.

Many of your customers' may have equipment beyond repair. The government permits the manufacture of a limited quantity of Griswold equipment for this need. Your Griswold man can help you in determining your customer's eligibility to buy now.



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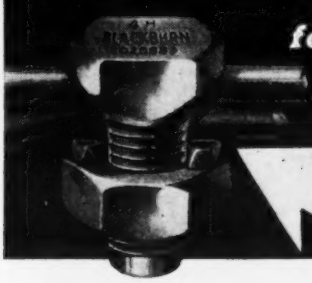
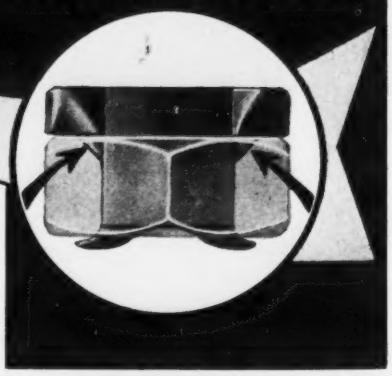
Like a Bridge
for Maximum Strength and Lower Maintenance Costs





Shown in circle is the nut and pressure bar of a BLACKBURN CONNECTOR. Small arrows indicate how this bar is *reinforced* on both sides. Like the tie rods on a bridge, these two reinforcements greatly strengthen the pressure bar, giving it maximum rigidity and enabling it to distribute the pressure over the entire length of the connection. Thus, the BLACKBURN reinforcing makes a strong connector still stronger!

Over 100 Conveniently-located Jobbers' Stocks

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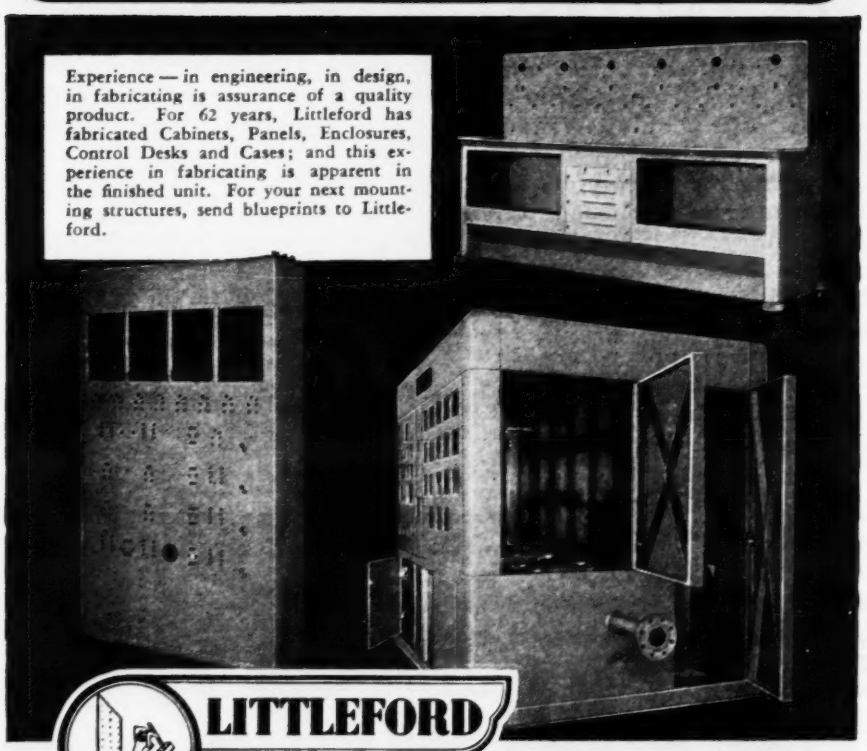
INSTRUMENT MOUNTING STRUCTURES

Experience — in engineering, in design, in fabricating is assurance of a quality product. For 62 years, Littleford has fabricated Cabinets, Panels, Enclosures, Control Desks and Cases; and this experience in fabricating is apparent in the finished unit. For your next mounting structures, send blueprints to Littleford.



LITTLEFORD

LITTLEFORD BROS., INC.
421 E. Pearl St., Cincinnati 2, Ohio

electric generating plants, with transmission lines, power substations, switching stations and other operating facilities. Also series of motor-driven pumping stations, to secure power supply from generating stations noted. Entire project is estimated to cost $13,695,000.

MISSOURI—Missouri Utilities Co., Cape Girardeau, will soon award contract for erection of proposed addition, 42 by 114 ft., to steam-electric power station, to be used for expansion in boiler house and generating division. A new river intake will be built. Project is understood to have a priority rating. No estimate of cost announced. Black & Veatch, 4706 Broadway, Kansas City, are consulting engineers.

TEXAS—Galveston County Board of Commissioners, Court House, Galveston, Boulevard Committee, N. L. Ballich, chairman, has approved installation of ornamental lighting system on boulevard. It is understood that this will be a post-war project. Metal or concrete standards will be used, spaced about 75 ft. apart. C. C. Washington, Court House, is county engineer.

TENNESSEE—Light, Gas and Water Department, Memphis, has plans under way for expansion and improvements in electrical distribution system, including new power substation, estimated to cost about $600,000, with transformers, switch gear and auxiliary equipment; extensions in overhead lines in different parts of city, $200,000, and similar expansion in underground conduit lines in downtown area, to cost a like amount; new meter installations to cost about $50,000, and other service facilities. Program is scheduled to be carried out in present year, and application will be made for a priority rating.

TEXAS—Central Power & Light Co., Corpus Christi, plans extensions in primary and secondary lines in four counties, for expansion in rural electric system. Cost estimated close to $100,000. It is understood that project will have a priority rating.

MISSOURI—Standard Oil Co. of Indiana, 910 South Michigan Ave., Chicago, Ill., has plans under way for expansion in oil refinery, comprising installation of new units for production of 100-octane gasoline for aviation service, including catalytic cracking unit and other processing departments. Project will comprise several one and multi-story structures, to be equipped for large capacity. Extensions will be made in power plant. Entire program is estimated to cost approximately $15,000,000, with machinery and electrical equipment. Project has a priority rating and work will begin soon.

CALIFORNIA—Bureau of Power and Light, 207 South Broadway, Los Angeles, has preliminary plans under way for conversion of part of former local system of Los Angeles Gas & Electric Co., now municipal property, to 5,000-volt service. Also similar conversion of former lines of Southern California Edison Co., likewise city property, to similar voltage noted. Projects will be carried out over a 36-months period after end of war, and are estimated to cost about $700,000 and $250,000, in order mentioned.

INDIANA—E. I. du Pont de Nemours & Co., Wilmington, Del., will make extensions in sulfuric acid works, for increased capacity for government. Cost about $400,000, with mechanical and electrical equipment.

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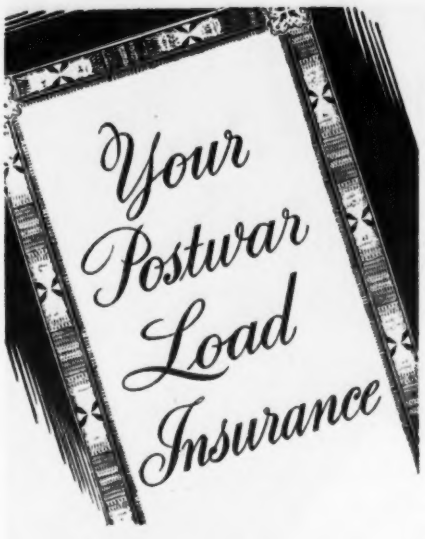
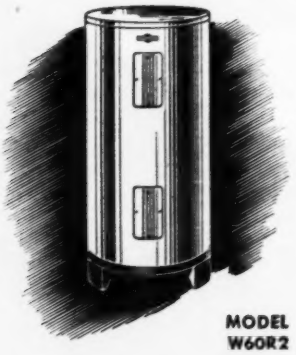


TOMORROW'S greatest domestic load building potential is automatic water heating. Demand for electric water heaters is estimated at *more than one million peacetime units!*

Public utilities can turn this unprecedented market into postwar load insurance. Electromaster Water Heaters—backed by the load building experience of an old line manufacturer—can assist in this program. Electromaster Water Heaters offer a quality, low-cost product to satisfy consumer needs and at the same time furnish a dependable, service-free unit to maintain off-peak load.

Put Electromaster in your postwar plans.



MODEL W60R2

ELECTROMASTER WATER HEATERS

are particularly efficient due to such features as direct-action, automatic thermostat, leakproof flange fittings, and thick mineral wool insulation.

ELECTROMASTER INC.
1811 E. ATWATER
DETROIT 31, MICHIGAN

Recent Legislation

Among the utility measures under consideration by the various state legislatures are the following:

GEORGIA—Senate had adopted the provision in the new State Constitution now under consideration, allowing counties and cities to issue debt certificates for the purchase and operation of electric and gas plants, but made the voting requirements somewhat harder. By a vote of 27 to 15, the Senate adopted an amendment that would require the assent of a majority of the registered voters in a county or city to issue revenue anticipation certificates for public utilities. The House had provided for the assent of only a majority of those participating in a referendum election.

IDAHO—The electric cooperative act, which its opponents said would have jeopardized state water rights and aided creation of a Columbia Valley Authority, was in effect killed recently in the Senate 25 to 14 on a motion to indefinitely postpone it.

NEW YORK—Bill has been introduced in the Assembly, which provides that the Public Service Commission after hearing may require gas and electric corporations, having optional rate schedules to give consumer written notice of lowest rate or form of rate available for class or quantity of service to which he is entitled, computed on basis of use during preceding year. The bill adds a new section to the Public Service Law and has been referred to the public service committee. Another bill introduced in the Assembly would bring electric submetering corporations under supervision of Public Service Commission, limit maximum rate to that fixed for electric utilities operating in same territory and except railroads and others generating electricity for distribution to their own tenants. Bill adds new section and amends Section 2 of the Public Service Law and has been referred to the public service committee. Under the provisions of a bill introduced in the Assembly and referred to judiciary committee, misrepresentation in sale of installation of air-conditioning system or equipment is prohibited. Such system or equipment is defined as provision for simultaneous and automatic control of temperatures, humidity and reduction in dust content and odor of air employed in ventilation. Under the provisions of a bill introduced in the Senate and referred to the public service committee, a new paragraph is added to the Public Service Law, providing that when application is made to Public Service Commission for authorization to issue bonds or other obligations of public utility, commission may require that they shall be sold at public sale to highest bidder after publishing notice in newspaper in county in which bonds are issued or in financial newspaper published in New York City.

TEXAS—A group of eleven bills to limit the operations of river authorities in Texas has been introduced in the Legislature by three members of a House committee which investigated two of the agencies. For river authorities which have been established under laws passed by the Legislature, the proposals would make these additional limitations: require them to use the Attorney General's department for legal aid and forbid employment of private counsel; forbid payment of commissions or brokerage fees upon property acquired by river authorities; limit them to ownership of hydroelectric generating facilities; limit directors' compensation to the stipulated per diem for attending board meetings, plus travel ex-

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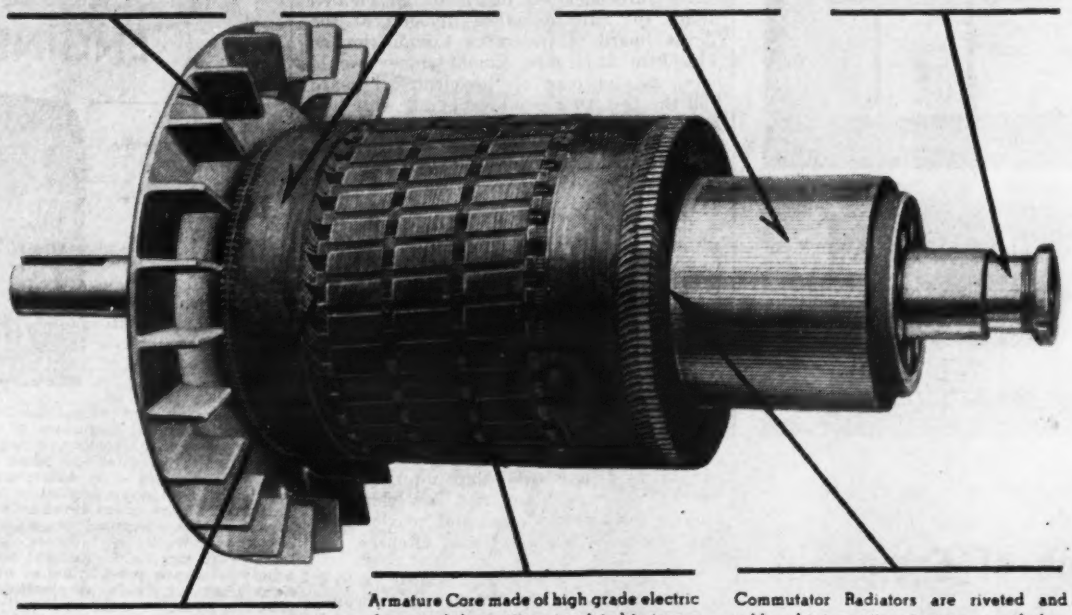
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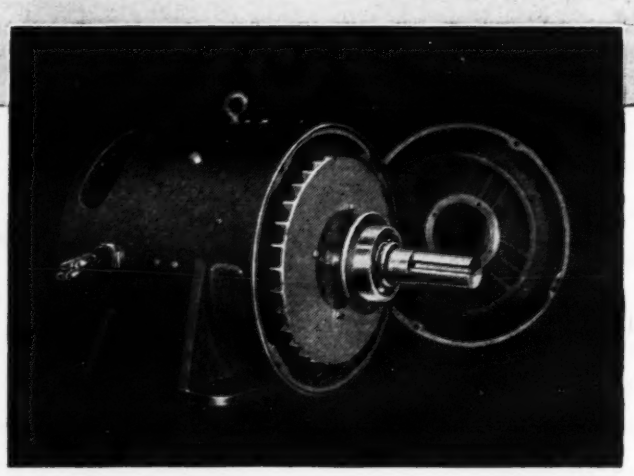

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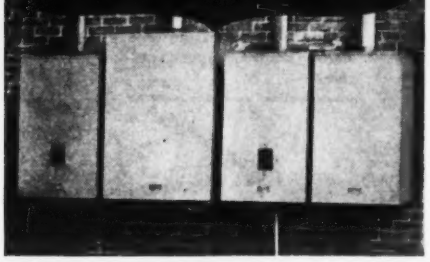

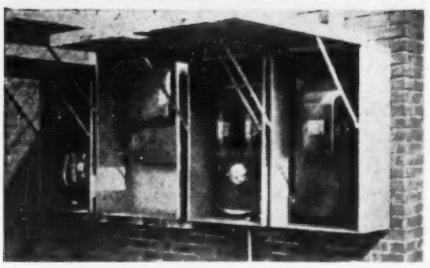

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pense; require fifteen percent of gross revenues to be set aside for such projects as flood control, conservation and reforestation; require all directors meetings to be at the legal headquarters; make bonds issued by the agencies subject to approval of the Legislature; limit maximum salaries for employees to the figure set by the Legislature for the chairman of the State Board of Water Engineers; confine real estate ownership of the authority to its own boundaries and forbid acquisition of electric facilities inside a municipality without the consent of the town's council. A bill to establish a State Electrical Board to license and supervice electrical installations has been introduced in the Legislature. The bill provides for a three-member board to be created under the fire insurance division of the Texas Board of Insurance Commissioners. The Fire Insurance Commissioner would serve as chairman of the electrical board and the Governor would appoint, with consent of the Senate, one recognized municipal electrical inspector and an electrical workers' union representative to serve.

OHIO—As an aftermath of the recent strike at the Cleveland Electric Illuminating Co., a measure has been introduced in the Legislature making it a crime for any employee of a public utility to go on strike during the war. The ban would affect only the public utilities and would include employees of electric light, gas, telephone, telegraph, water works, express, sleeping car, freight line, pipe line, messenger, signal, union depot, water transportation, heating, coaling, street railway and railway companies. The measure provides a fine of not less than $500 and imprisonment in the workhouse for not less than six months for a first offense, and heavier fines and sentences for additional offenses.

WASHINGTON—The House, voting 78 to 8, sent a measure to the Senate which would require private utility companies to sell power wholesale to public utility districts that have taken over any part of the property. Public power, center of interest in numerous previous sessions of the Washington State legislature, has appeared at the present session in the form of an amendatory proposal offered by House Speaker George F. Yantis to enable public utility districts to sell or lease any of their properties to any other P.U.D.'s, cities or other public agencies without submitting the proposition to the electors. Two-thirds affirmative vote of electors would continue to be required to authorize disposal of properties to private sources.

•

Recent Rate Changes

NEW MEXICO ELECTRIC SERVICE CO.'s new rate schedule in Hobbs has been approved by the state Public Service Commission. The new rates will be effective on all billings after March 20. The electric rate reduction was said by the commission to amount to 12 percent.

ONTARIO HYDRO-ELECTRIC SYSTEM reduction in electric rates in Forest Hill (Ont.) has been approved by the town council. Consumption charges of 2.7 cents per kilowatt-hour for the first 60 kw.-hr. per month was reduced to 2.5 cents. The second rate was cut from 1.2 cents to 1.1 cents.

WESTON (ONT.) PUBLIC UTILITIES COMMISSION has announced a reduction in hydro rates, which in some instances will amount to as much as 13.5 percent. Reductions apply to domestic, commercial, power and flat rate water heaters.

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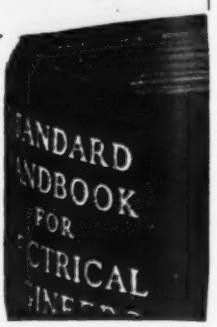

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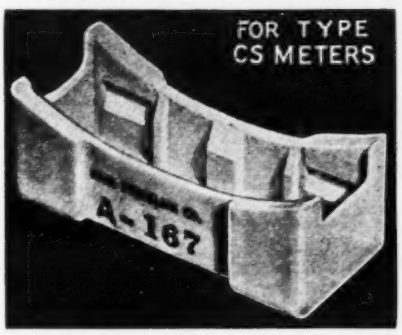

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REA Funds Allotted; Contracts Approved

The Rural Electrification Administration recently announced the approval of allotments totaling $539,550 to 13 co-ops in nine states. The funds will be used mainly for extension of electric service to farms located near existing lines. No construction will be undertaken which does not meet with WPB approval.

This brings total REA allotments to $521,790,351, of which $22,910,550 represents operations during the current fiscal year.

Unless otherwise noted, loans listed below will provide for service extensions.

ILLINOIS—Rural Electric Convenience Co-operative Co., Divernon, $50,000.

MICHIGAN—Tri-County Electric Cooperative, Portland, $50,000.

MINNESOTA—Goodhue County Cooperative Electric Assn., Zumbrota, $25,000.

NEBRASKA—Burt County Rural Public Power District, Tekamah, $10,000; Seward County Rural Public Power District, Seward, $10,000; Stanton County Rural Public Power District, Stanton, $10,000.

NORTH CAROLINA—Ocracoke Electric Membership Corp., Ocracoke Island, $38,550, for emergency rehabilitation and refinancing.

NORTH DAKOTA—Minnkota Electric Power Cooperative, Inc., Grand Forks, $125,000 for purchase and installation of diesel generating unit.

OKLAHOMA—People's Electric Cooperative, Ada, $16,000.

PENNSYLVANIA—Central Electric Cooperative, Inc., Parkers Landing, $75,000.

TEXAS—Lower Colorado River Electric Cooperative, Inc., Giddings, $50,000; Pedernales Electric Cooperative, Inc., Johnson City, $50,000; Cooke County Electric Co-operative Assn., Muenster, $30,000.

Construction Contracts Approved

FLORIDA—Florida Keys Electric Cooperative Assn., Inc., Tavernier, to Burnup & Sims, Inc., West Palm Beach, Fla., Salvage operations; $2,972.

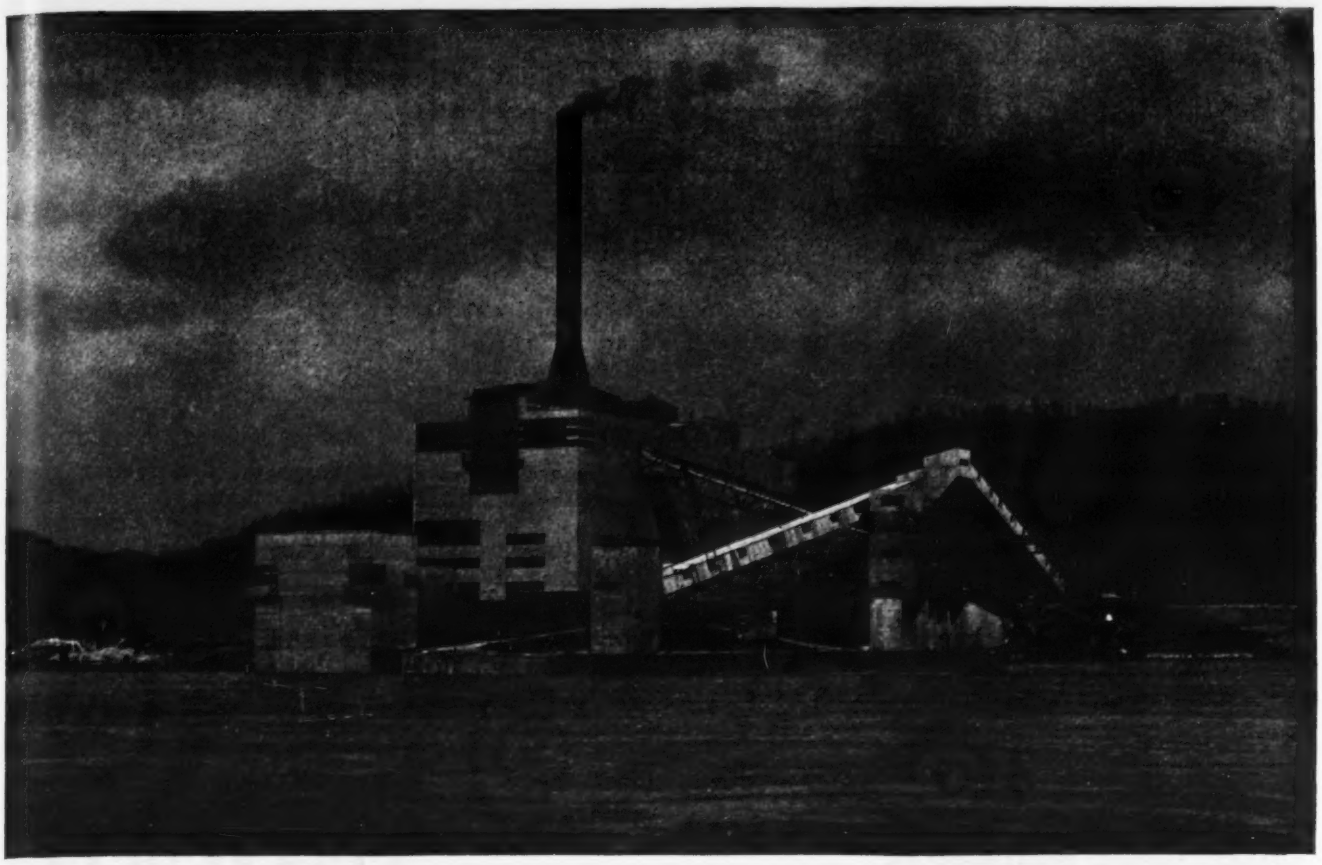
MINNESOTA — Minnesota Valley Cooperative Light & Power Assn., Montevideo, to O. A. Mork, Clarkfield, Minn., 52 miles of line; labor only, $13,399.

MISSISSIPPI—Delta Electric Power Assn., Greenwood, to Stuart C. Irby Co., Jackson, Miss., 102 miles of line; labor only, $22,160. Coahoma Electric Power Assn., Clarksdale, to Line Construction Co., Clarksdale, Miss., rephasing work on 29 miles of line; labor and materials, $9,968.

•

Reports Record Output

The Hallicrafters Co., Chicago, is experiencing one of its heaviest production periods. According to the company announcement, the production upsurge, in its initial phase, made December the busiest month of 1944. Its peak is expected to be reached sometime during the January-February-March period when an increase of at least 20 percent over even busy December is expected.



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LETTERS TO THE EDITOR

Polyphase Meter Connections

To the Editor of ELECTRICAL WORLD:

Having noted the article by W. C. Noddings in the December 23, 1944, issue of ELECTRICAL WORLD titled "Check Meter Connections Without Tracing Wires," I would like to venture the suggestion that the method discussed is by no means infallible. In its application, it is necessary to make certain assumptions based on probable connections, and where any assumptions whatever must be made, sureness of results cannot be guaranteed.

I would also like to refer Mr. Noddings to an A.I.E.E. paper presented at the mid-winter convention in New York, February 9, 1916, by W. B. Kouwenhoven, titled "A Method of Determining the Correctness of Polyphase Watt-meter Connections," which is the most complete discussion of the subject that I have ever seen. In this paper, Mr. Noddings' method is discussed from a rather complete technical viewpoint and its complete application is a rather complicated procedure. I should think that, since the necessity for making any such checks can be most easily and readily avoided, it would be far more practical to use installation methods that make any such checking unnecessary.

After all, if the integrity of any equipment used in a meter installation is proven before installation and all connections made so that they may be readily and adequately checked at any time, the integrity of the complete installation may be easily and readily assured with great positiveness and the "rough" electrical checks suggested made entirely undesirable.

All of the meters discussed have eight terminals to which eight wires must be connected. There are 40,320 different ways in which these wires may be connected to the eight terminals. If a "standard" method of connections is adopted and used, then only one of these 40,320 possibilities is correct and this applies only to the immediate connections at the meter. Of course, many of the possible connections produce the same electrical conditions, and many obviously would not be made by one with any knowledge at all of the subject but to be sure that all connections are proper it seems to me that the safest way is to adopt a "standard" which provides for the necessary connection checks at any time and then

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see that it is used universally and accurately.

May I suggest, too, that the EEI "Symbols for Metering Diagrams," publication No. C10, be used for wiring diagrams of this type? I think such use will improve the readability of the diagrams.

F. E. Davis
The Commonwealth & Southern Corp.
Jackson, Michigan.

The symbols to which Mr. Davis refers are to be found in Section 3 (pages 23 and 26) of the *Electrical Metermen's Handbook* (a 1940 publication of Edison Electric Institute).—Editors

To the Editor of ELECTRICAL WORLD:

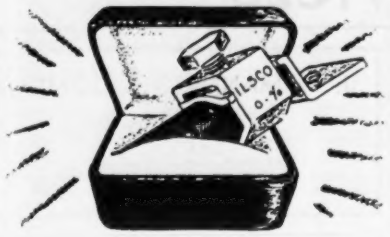
The correct meter connection shown in ELECTRICAL WORLD, December 23, 1944, was the correct way to connect the old potential transformers with additive polarity, so could be called correct.

Either way would be correct by following through on the same polarity markings with additive or subtractive potential transformers. If primary marker is connected to Phase A, then the secondary white marker is connected to the line of the meter. The result will be as the old sketch showed, just to make it easy to check.

There are several correct ways to properly connect a three-phase meter. Color coded wires should be used and not rely on tracing the wires. For instance red No. 12 for line current and red No. 14 for potential to same phase and meter element is easy to check. Then a black No. 12 for current for the other phase and a black No. 14 potential for corresponding phase with a common No. 10 white grounded makes a simple way to check. Why not make all installations standard and uniform for the meter tester and checker.

E. E. Millington, Manager
Lexington Electric Service
Lexington, Nebraska

Evidently industrial electrical engineers could profit by following the symbolism and standards set up by power companies to avoid confusion and misinterpretation of metering diagrams—Editors.



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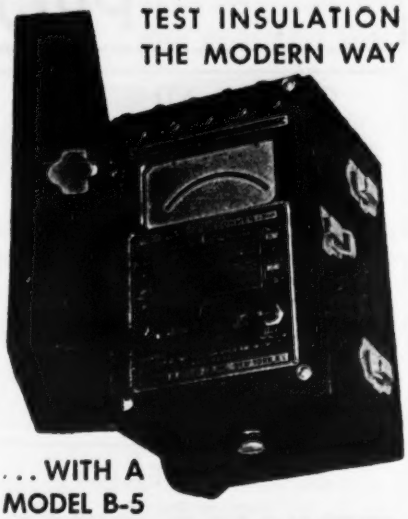

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MIDWEST ELECTRIC Utility needs superintendent for steam generating station. He should be a graduate engineer with a background of not less than 8 years steam power plant experience. Age 30 to 40. Write details of experience, qualifications and availability. P-841, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	660	600
1—	700	G.E.	MPC	250	200/360
2—	625	G.E.	MPC	500	160
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	500	Whse.	Compen.	250	800/720
1—	350	G.E.	MPC	220	450
1—	300	G.E.	MPC	230	275/550
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	MPC	230	250/450
2—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO-	230	625
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-38	230	600
1—	75/100	Whse.	SK-183	230	450/900
1—	75	G.E.	LC	230	500/1000
2—	75	Whse.	SK-183	230	560/1100
1—	60	Al. Ch.	E-131	115	1750
1—	60	El. Dy.	258	230	424/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
1—	50	G.E.	RC-19	230	400/1200
2—	40	El. Dy.	308	230	300/900

TRANSFORMERS

KVA	Make	Ø	PH	Type	Voltage
3—	1667	Pitts	1	OISC	13200x2300
1—	1050	G.E.	3	WCTH	11000x445
4—	525	G.E.	1	HJDD	2300x445
4—	500	Pitts.	1	OISC	13200x2300
3—	333	Moloney	1	C-OISC	22000/11000x2300/575
2—	333	Whse.	1	OISC	2300x460
2—	333	Pitts.	1	OISC	2400x220
3—	300	G.E.	1	H-RP	13200x575/1150/2300
1—	300	Pitts.	3	ODSC	4150x208/120
3—	200	G.E.	1	H-IDD	6400x115/460

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3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW G.E. 250 V. DC to 1400 HP 2300 V.
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1—750 KW Whse. 275 V. Gen. d.c. to 1100 HP 2300 V.
1—750 KW G.E. 250 V. Gen. d.c. to 1080 HP 2300/4150 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
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1—350 KW GE 220 V. AC Gen. d.c. to 500 HP 250 V. DC motor.
1—300 KW GE 600 V. Gen. d.c. to 435 HP—2300 V.
1—250 KW GE 250 V. DC to 375 HP—440 V.
1—200 KW GE 125 V. Gen. DC to 300 HP—440 V.
1—75 KW GE 125 V. Gen. to 120 HP IK 400/2300.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.

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1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 Cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.E.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

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A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
2—	2100	G.E.	ATI	2300/4600	514
1—	600	Al. Ch.		2200	720
2—	200	G.E.	TS-7644	2300	900
1—	100	Whse.	G	2200	1800
1—	75	G.E.	TS-7556	220/440	900

Slip Ring

1—	1200	Cr.-Wh.	801-Q	220	237
1—	800	Al. Ch.		440	885
1—	600	G.E.	MT	550	220
1—	600	Cr. Wh.	131-AQ	2300	507
1—	500	Al. Ch.	ANY-36	2300	590
1—	450	Whse.	CW	2200	875
1—	400	Al. Ch.		2300	505
1—	400	G.E.	IP	2200	252
1—	350	G.E.	MT-412y	550	390
1—	300	G.E.	IM	2300/4000	257
1—	250	G.E.	MT	4000/2300	257
3—	250	Whse.	CW	2300	435
1—	150	Whse.	CW-772C	2200	1160

Squirrel Cage

1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150

SYNCHRONOUS CONDENSERS

1—	5000	Whse.		2300/4150	900
1—	3000	Al. Ch.		2300	900
1—	2000	G.E.	ATI	600	900
1—	2000	Whse.		2400	720
1—	1000	G.E.	ATI	2200/3800	900
1—	900	G.E.	ATI	2200/6600	1200
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1— 75 KW, 125 volt, General Electric, squirrel cage.
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1—6½ KW, 125 volt General Electric, squirrel cage.

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1—400 H.P., 220 volt, 1200 RPM, Westinghouse squirrel cage.
1—350 H.P., 300 RPM, 400 volt, General Electric slip ring.
1—250 H.P., 600 RPM, 2200 volt, General Electric slip ring.
1—200 H.P., 1800 RPM, 220 volt, General Electric slip ring.
1—200 H.P., 600 RPM, 550 volt, Westinghouse slip ring.
1—200 H.P., 600 RPM, 440 volt, Crocker-Wheeler slip ring.
1—150 H.P., 1800 RPM, 440 volt, General Electric squirrel cage.
2—150 H.P., 1800 RPM, 220 volt, Westinghouse slip ring.
1—150 H.P., 400 RPM, 440 volt, General Electric squirrel cage.
3—100 H.P., 720 RPM, 440 volt, General Electric slip ring.
1—100 H.P., 600 RPM, 2200 volt, General Electric slip ring.
1—100 H.P., 450 RPM, 440 volt, General Electric squirrel cage.
1—100 H.P. 1800 R.P.M., 440 volt, G. E. squirrel cage.
1—85 H.P. 900 R.P.M., 220 volt, G. E. synchronous.
2—75 H.P. 900 R.P.M., 220 volt, G. E. slipring.

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2—25 KW, 125 volt, direct current
130 KW, 125 volt, direct current

1— 90 H.P., 400 RPM, 650 volt, Crocker-Wheeler squirrel cage.
1— 75 H. P., 900 RPM, 4000 volt, Electric Machinery synchronous.
1— 75 H.P., 720 RPM, 440 volt, Westinghouse slip ring.
1— 60 H.P., 1200 RPM, 440 volt, General Electric slip ring.
1— 50 H.P., 1800 RPM, 220 volt, Fairbanks-Morse slip ring.
1— 50 H.P., 900 RPM, 440 volt, General Electric slip ring.

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2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker-Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

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3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
2—50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—50 KVA, Pittsburgh, 2200-220/110.
3—37½ KVA, General Electric, 2200/220/440
1—25 KVA, G.E., 220/110-20/110 volts.
3—25 K.V.A. G. E. 2200—220/110.
2—15 KVA, G.E., 2300-115/230 volts.

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1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 300/990 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type, SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

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1—375 KVA, Westinghouse, non-condensing.
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1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

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2—300-kva. GE, type IRT-2-300-4800-360, 10% regulation, form A73, 60-cycle, indoor, air-cooled, PV-4800-360-amp, serial #4516817.8. Induction motor operated, GE, type KT-548-8-900, form C, 3-phase, 60-cycle, 220-volt.

SYNCHRONOUS CONDENSER

1—3000-kva Allis-Chalmers, 2300-volt, 754-amp, 3-phase, 60-cycle, 900 rpm, serial #124571.

Exciter: Direct-connected, Allis-Chalmers, 125-volt full load, 200-amp, 900 rpm, serial #124569.

Starting Motor: Direct-connected, Allis-Chalmers, slip-ring, 100-hp, 2300-volt, type ARY, 3-phase, 60-cycle, 1150 rpm. Control Panel: Cubicle, 9'6" high, 52" side, 48" deep, starting and running switches mounted in cubicle.

CIRCUIT BREAKERS

2—Westinghouse, 0-33, 600-amp, 25000-volt, TPST, solenoid-operated, 125-volt.
2—Westinghouse, CO-2, 600-amp, 24000-volt, TPST, solenoid-operated, 125-volt.
2—Westinghouse, CO-22, 600-amp, 24000-volt, TPST, solenoid-operated, 125-volt.

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Salvage Sales Department

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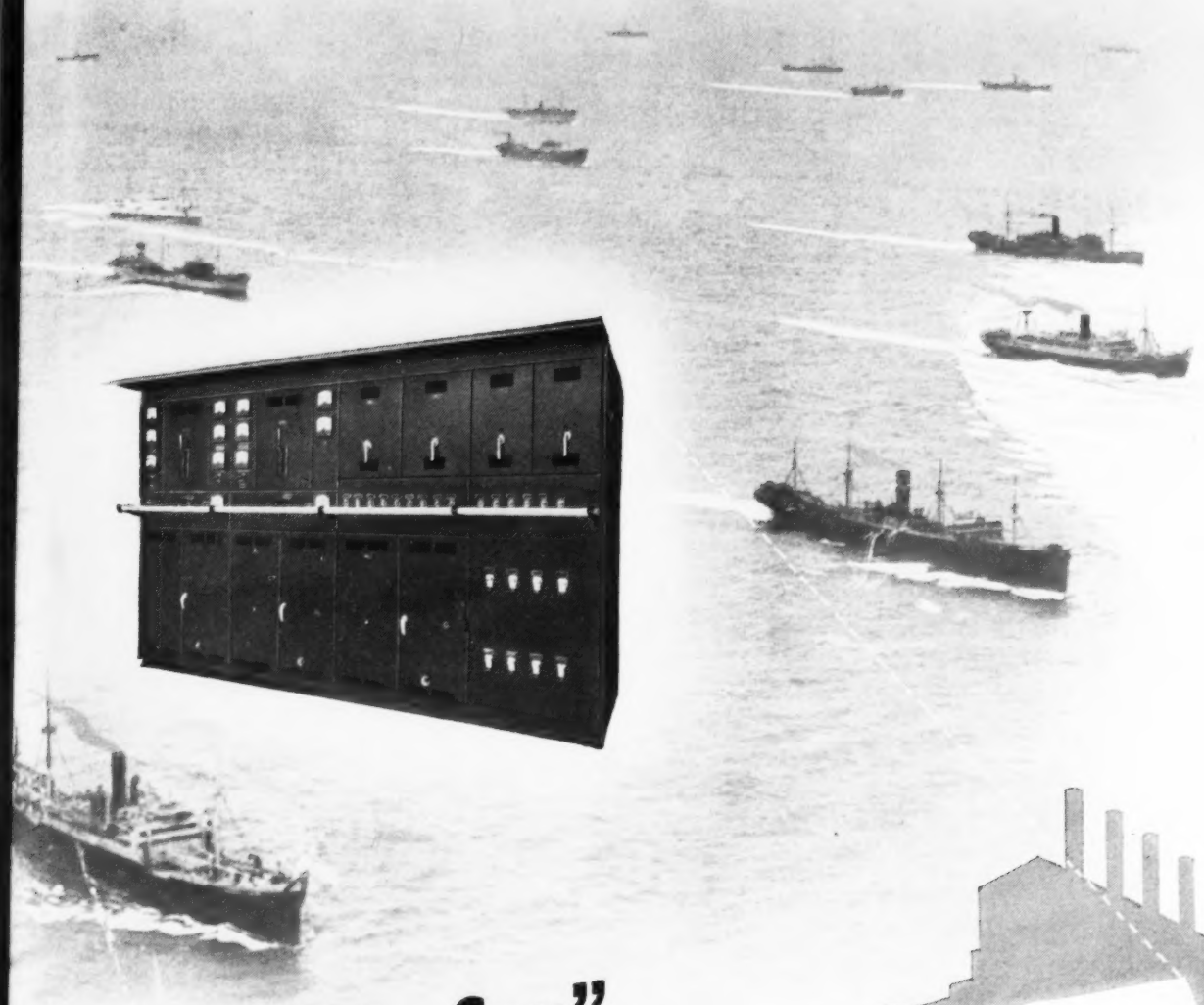
★ **These companies have supplied additional buying information on their products in the 1945 edition of the Electrical Buyers' Reference**



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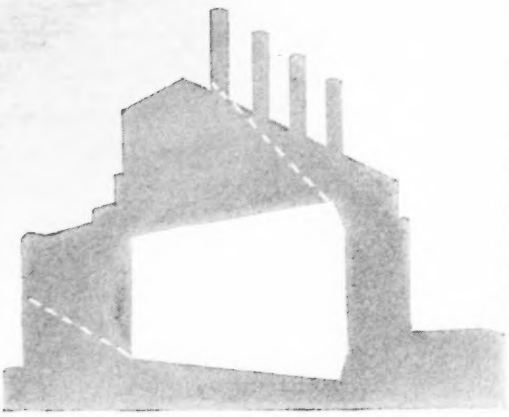

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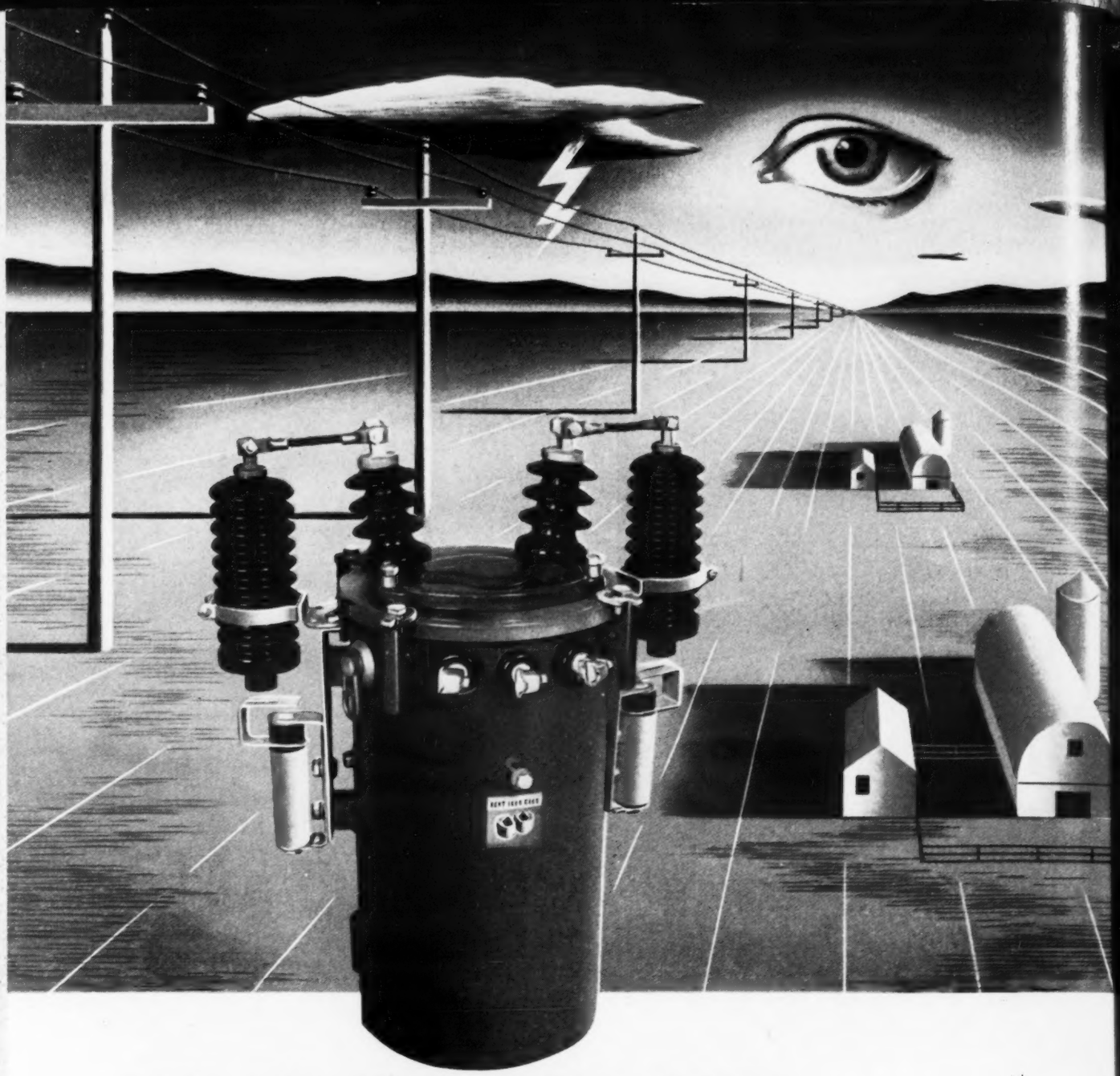

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